THE FIELD OF DISEASE.

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A BOOK OF PREVENTIVE MEDICINE

BY

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TO THE ROYAL LITERARY FUND.

"*Homines ad deos nullâ re propius accedunt quam salutem hominibus dando.*"
CICERO.

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TO

RICHARD OWEN, C.B., D.C.L., F.R.S.,

IN HOMAGE TO GENIUS,

IN ADMIRATION OF INDUSTRY,

IN REMEMBRANCE OF LONG FRIENDSHIP,

THIS BOOK

IS INSCRIBED.

AMERICAN PUBLISHERS' NOTICE.

THE prevention, no less than the cure of disease, is now understood to belong to the function of the physician, to whom alone the public can look for protection as well as for rescue. As the author very truly says: "The conception that these afflictions can be prevented is of modern times, and indeed we may say practically of the present century, or even of the later two-thirds of the present century;" and it would seem that the time had now come in which the results of the investigations and experience as to the relations between health and disease should be summed up, not only for present use but as a starting-point for further acquisitions in this supremely important field of knowledge.

Although Dr. Richardson assumes that the present volume is intended primarily for the public, the publishers have, for the reason just stated, no hesitation in laying it before the profession, being advised that it contains much with which every physician should be familiar, while there is no work in the language in which the information here presented can be sought, systematically arranged, and intelligibly presented.

PHILADELPHIA, November, 1883.

PREFACE.

I HAVE written this work for those members of the intelligent reading public who, without desiring to trench on the province of the Physician and Surgeon, or to dabble in the science and art of medical treatment of disease, wish to know the leading facts about the diseases of the human family, their causes and prevention. Any one, therefore, who opens this book with the expectation of finding in it receipts and nostrums will not have that expectation fulfilled, and will discover reference to no remedies except such as are purely preventive in character.

To adapt the book to the general reader I have carefully avoided most of the new names and terms which have recently stolen their way, at a rapid rate, into the literature of medicine. This was a necessity which I do not regret, because the old historical terms with which the people have become familiar are, as a rule, far more correct and classical than the new terms which have been introduced by modern caprice and love of change rather than by learning and judgment.

For the same reason I have kept pretty closely to that classification of diseases which has descended from the best scholars in medical science and art, and which, through their labors, is best known to the people at large.

For the objects and intentions of the book I respectfully refer the reader to the first or introductory chapter, in which all that is desired to be achieved is fully expressed.

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BOOK THE FIRST.

DISEASES.

DISEASE AS UNITY WITH VARIETY OF PHENOMENA.

THE PREVENTIVE SCHEME OF MEDICINE.

In this work we have to study first the nature, secondly the causes, and afterwards the prevention of those calamities which afflict mankind, and which have received the title of diseases. The conception that these afflictions can be prevented is of modern times, and indeed we may say practically of the present century, or even of the latter two-thirds of the present century. The idea which came down almost to us who now live was that diseases of every kind were a portion of the necessary sufferings of human existence, sufferings which might by some art, or conjuration or divination, be removed, but which could not be avoided or prevented. For this reason the so-called curative art, the art of relieving or removing diseases, took, naturally, a first place in the course of human progress. This curative art, brilliant in many of its discoveries, useful in many of its applications, and beneficent alike in discovery and application, could not, however, be expected forever to remain the be-all and end-all of human effort against disease. It was wonderful while it combated the unknown and the invisible. But in course of natural development of knowledge the unknown and the invisible passed away, in so far as belief in them was concerned, and there was left on the mind, in place of that belief, the fact that not one of the diseases long thought to be supernatural and out of the range of inquiry as to first causes, was supernatural at all. Each was traceable, by the acquirement of correct knowledge, and, when traceable, was largely and effectively preventible by a further extension of the same acquirement.

In this manner has arisen the science and art of preventive medicine. It is not a science, it is not an art separated necessarily or properly from so-called curative medicine. On the contrary, the study of prevention and cure proceed well together,

and he is the most perfect sanitarian, and he is the most accomplished and useful physician, who knows most both of the prevention of disease and of the nature and treatment of disease; he who knows, in fact, the before and the after of each striking phenomenon of disease that is presented for his observation.

If I were to speak of the progress that has been made in the past thirty years, I should be obliged, in candor, to confess that great losses of time and great injuries to advancement have been caused by the circumstance that the unity of the two labors has not been duly recognized. A few enthusiastic men, devoted almost exclusively to the grand and new instauration of medicine in its preventive character, have, if I may so say, made war on the curative system which has held such long, such undisputed, and such classical sway. They have consequently often been led to speak and write about diseases without any accurate knowledge of the natural history of disease after its birth, and so have inflicted harm on the principles of preventive art. To use an appropriate simile, they have reasoned on diseases as another school of philosophers might reason on the antecedents of unborn individuals without knowing anything whatever of the natural history, or the natural life, or the natural peculiarity, or the natural termination of the lives of those individuals after they had come into existence.

All this has led to unnecessary and often to enthusiastic and extravagant warfare; and it has had the effect of interrupting the order of reformation of thought amongst the representatives of the curative school, who by inheritance have held the study of disease in their hands. These having few treatises of the past, or little wisdom of the past, descending from great and acknowledged masters, to guide them on the subject of the prevention of first or antecedent causes of disease, have held obstinately by their own principles, and have sometimes stoutly resisted what they have conceived to be an ignorant encroachment on their rightful domain.

I confess, for my own part, I have had great sympathy with the curative school, in which I was bred, and with which I remain associated too closely ever to be disconnected from it. At the same time the truth must now be candidly admitted, that the system of relieving mankind of its misery and load of disease can no longer rest alone on what is called curative skill. We have en-

tered an era in which the steady effort must be, not only to cure disease, but to cure cure. The men who have proclaimed the art of prevention, based upon the art of learning the antecedents of the phenomena of disease and the reasons why diseases are developed at all, are right in principle however widely they may sometimes have erred in details of facts and in endeavors after practical attainments for the realizations of which they were not ready, and for many a long day will not be ready.

The grand work of this era is to reconcile the two different schools; to systematize the preventive part of medical science, so far as that is now known; to bring the preventive part into entire accord with the remedial; to let the world at large understand the interrelationships which exist between the two parts; and, by a sympathy of action, based on knowledge, to enable every man and woman to assist in that part which tends towards prevention.

With the objects here expressed I write this present volume. I have nothing to say in it that has any relation to the cure of diseases. I base it nevertheless on the curative side of medical learning. In other words, I strive to trace the diseases from their actual representation, as they exist before us, in their natural progress after their birth, back to their origin, and, as far as I am able, I try to seek the conditions out of which they spring. Thereupon I endeavor, further, to investigate the conditions, to see how far they are removable, and how far they are avoidable.

The success of my effort will turn on the success with which I am able to carry out this analytical and practical design. I may say at once that I know the effort, though it be ever so laborious, cannot be perfect. The wisest of us who look at disease are still like persons watching the progress of a dramatic representation. We see the various characters, we hear them speak, we observe the scenic conditions, we understand the plot and its development; but as yet we are not acquainted with the players, we are not behind the scenes nor conversant with the very simple means by which the most startling effects are often produced. It is my wish to get at all the truth, as far as is possible, in the study of the phenomena of the great tragic drama of disease which is ever being enacted before us. I ask no pardon for apparent or real failure wherever it occurs, because I am sure that frequent failure in this stage of human knowledge is inevitable. At the same

time I know, at the outset, that the attempt cannot be laboriously made by any one without securing some success, since by such an attempt the general reader may be led to learn certain facts which will be useful to him as facts, though he cast all generalizations to the winds as learned dust. By such an attempt the critical reader also may be led to go deeper than he has gone, perchance, into a subject worthy of his criticism, and may thereby have the opportunity of giving to the world a good market of his own founded on my imperfections. Lastly, by such an attempt the candid, thoughtful, and original students of nature in the future, —and they are the men and women I would specially win,—may be induced to follow out, with greater knowledge and wisdom than pertains to me, the height of this argument, and from their more commanding position to recast it perfected.

BOOK I.

PART THE FIRST.

GENERAL DISEASES AFFECTING MANKIND.

CHAPTER I.

OUTLINES OF GENERAL DISEASE.

Let us before we proceed further glance in a preliminary way at some of the evils which, under a correct system of preventive medicine, have to be removed from mankind. Let us, in other words, glance at those phenomena of nature which in their variety constitute what is called disease.

Disease is unity with a variety of phenomena. Disease is a departure from a certain assumed standard of health either in the individual as a whole living body physically and mentally existing, or of a part of that body; and, without any error, I may say a part of that mind. For this reason the phenomena of disease have, from very early times, been divided into the general and the local. This division has in late days been re-affirmed by no less an authority than a Committee of the Royal College of Physicians, which has reported on the "*nomenclature of disease.*" The College defines *general diseases* to be such "as affect the whole frame rather than any special part of it," and *local diseases* to be such "as occupy special parts of the body."

Under the head of general diseases the same authority enumerates *fifty-eight* forms. Under the head of local diseases it enumerates *eight hundred and forty-three* varieties. To these it adds *ninety-one* of "other conditions of disease" which are not necessarily associated with general or local diseases, and which include premature birth; old age; debility or "uniform exhaustion of all the organs of the body without specific disease;" the affections arising from the action of the various animal, vegetable, and mineral poisons; and the affections arising from wounds inflicted by poisonous animals. In conclusion it also adds *one hundred and fifty-five* forms of injuries, (*a*) general, such as burns and scalds; (*b*) local, such as fractures and other mechanical injuries of parts of the body.

The result of this calculation gives us a grand total of *one thousand one hundred and forty-six* variations from health as making up the conditions and the phenomena of disease to which the human family, at this period of its civilization, may be subjected.

A philosophical friend who has no practical knowledge of disease, tells me he is surprised to learn that the number of diseases is so small. It is in truth very much smaller than above stated. The learned men who with infinite labor have drawn up this latest record of diseases, a record historical in its character and singularly practical, were bound, by the nature of their task, to retain much that they might have thrown aside, and which they doubtless would have thrown aside had they been classifying diseases on any philosophical system that might lead to condensation. This was not their duty. They were compelled to simplify names and classifications in such a manner and to such an extent as to keep their record in harmony with current knowledge and method of description, and to adapt it, without too rapid transition of thought or practice, to the requirements of medical men everywhere, to the million of physic, throughout the world.

And so we may start with the great fact in our minds, a fact we may afterwards use for whatever necessary purpose we may be at in illustrating prevention, that there are, in detail, before the scholar of the preventive art one thousand one hundred and forty-six diseases affecting mankind which he has to study with a view to their abatement or removal.

In the classification of diseases which the most recent authoritative effort at classification has supplied, the difficulty of establishing a sound and simple mode of classification is set forth with all candor. Diseases, say the College reporters, might be classified according to their symptoms; their causes, their intimate nature; the tissues or the systems of the body that are affected; or the parts of the body as they lie anatomically. After due consideration the reporters determined to follow the anatomical plan, and to base their classification upon anatomical considerations. Thus, after dividing the fifty-eight general diseases into two classes, a class (*a*) of thirty-three diseases, including all that are infectious and contagious, and a class (*b*) of twenty-five diseases, including the great constitutional maladies, such as gout, cancer, scrofula, they pass afterwards to the classification of one thousand and

eighty-eight local diseases,—diseases having a localized seat in some organ or part rather than in the body altogether,—and thus they complete their laborious and important undertaking.

Taking the work of the Royal College as a general basis and direction, I would now proceed to place before the reader the descriptive list of the general diseases affecting mankind. Before passing to this task it will, however, be necessary to render familiar certain terms, which are in common use amongst the learned for expressing what may be called attendant conditions of disease; conditions which may be present in the course of different diseases, and common to them in various stages, but which are not strictly diseases themselves, though much may depend on their presence or their absence.

The facts relating to these conditions apply to the part of this book which treats of general diseases. They apply also to the part which treats of local diseases. In fact they cover the whole field of disease. We will consider them in a special chapter.

CHAPTER II.

CONDITIONS OF DISEASE.

The conditions of disease referred to in the last chapter and now inviting definition and brief exposition may be classified under fifteen heads.

1. Fever.

It is customary to say of persons suffering from various acute diseases and from some slow or lingering diseases, that they have fever; that the fever runs high; that the fever is reduced; that the fever is intermittent, and so on.

Under this term fever, the older writers sometimes meant one special disease, which they defined no further. Afterwards fever began to be considered under two heads, according as it was or was not communicable. Thus there were *contagious fevers*, or such as were communicable by touch and could be conveyed by something that was capable of being carried from the affected to the healthy; and there were *infectious* fevers, or such as could be contracted by coming into immediate contact with the poison that was emanating from the affected. Again, there were fevers which were neither contagious nor infectious—*simple fevers*; or which ran a continued course, *continued fevers*. By another change of expression fever was connected with diseases of particular organs, as with the brain, *brain-fever*, or with particular functions or states, by which method of expression we got such terms as *milk-fever* and *child-bed fever*. Once more fever was connected with another general term, inflammation, so giving rise to the term *inflammatory fever*; or it was considered to be the result of some irritation, from which view was derived the expression *irritative fever*.

In these days we have not lost these expressions, but we use them, when we are speaking correctly, with more precision. We

have now learned to take with the thermometer the temperature of the human body, and we accept the natural temperature to be 98.4° Fahrenheit in temperate climates, with a range of two-tenths on either side, below for arctic, and above for tropical conditions. It is the fact even in what may be considered health that these ranges may be extended on either side for short periods of time, but practically the figures are sufficiently correct. When therefore the temperature of the body is shown by an accurate thermometer to be 98.4° Fahrenheit, we consider there is a natural temperature. When the temperature is above 98.4° in any marked degree we say there is *fever*.

We must not boast that by this definition we have added much to human knowledge, for the most ancient physicians and scholars gave us a similar, if less precise, statement, and went so far as to discuss whether fever could exist of itself without any preceding change in the body, such as inflammation. But we have gained, by the labors of many hard-workers, by those of the late Dr. Wunderlich especially, a correctness in the reading and the detection of the range of fever that was never before attainable. From its intensity we now measure fever and its dangers with almost exact detail: so much fever, so much or so little danger, so much probability of recovery, so much probability of death.

By the term fever in these days we mean an elevation of animal temperature varying in degree, and when the word is used alone we mean nothing else. If the fever is one, two, or three degrees above the natural, we look upon it as mild in form. If it runs up to four and five degrees above the natural, we say it indicates danger; if it rises over six degrees, the danger is imminent; when it passes seven, the chance of continued life is very small; and, at eight degrees, if the condition continue very long, death is all but certain. At an increment of eleven degrees of heat above the natural, on Fahrenheit's scale, continuance of life is, with the rarest of exceptions, impossible. Before that stage is reached the minute blood-vessels have undergone contraction; the muscles of the body, generally, have shown a tendency to spasmodic contraction which may pass into tetanus; and the blood has, in some instances, commenced to separate into two parts, or, as it is commonly said, it has commenced to set, or coagulate.

Fever thus viewed becomes a condition of disease running

with other conditions which may, locally, be more apparent, but which in a general sense cannot be more definite. It is not a basic condition, for it is a result of something that preceded it. But it determines the after results so decidedly that to retain it as if it were basic, and to speak of irritative fever, inflammatory fever, contagious fever, intermittent fever, hectic fever, tetanoid fever, scarlet fever, spotted fever, malarial fever, and the like, is quite correct if we only keep in mind the simple truth that the added words merely express either the origin, or the course, or the phenomena of the febrile state.

A good simile is given to us of this in the example of a common fire. Fire is not a base; it is a result; and yet it determines consequences so decidedly that it very soon becomes the one dominant fact. Fire may be sharp, slow, bright, smouldering, accidental; it may be a coal fire, a wood fire, a peat fire; it may be continued, intermittent, subdued, wild; and by all such terms we may distinguish its character. Instead of serving its intended purpose in the house or manufactory, it may be playing the part of a destroyer. Fever is the counterpart of this in the house of life; it is the animal fire burning beyond what is natural, excited to that burning by something that was, in a basic sense, the prime cause of the condition of disease.

The influences which set up fever in the animal body are many. If sensitive nervous surfaces be rubbed or irritated so that pain results there is an increase of temperature, *irritative fever*, a fever probably of short duration and harmless in kind, lasting only so long as the irritation lasts and dependent on the disturbed nervous balance, but still present. If, from local causes, an organ of the body becomes inflamed, there is soon some increase of temperature, or fever, *inflammatory fever*, which will vary in intensity with the extent of the inflammation, and will probably subside with the inflammation, but will not fail to be present. If some foreign substances, minute particles of matter,—fever-poisons,—be introduced into the body, they may modify the animal chemistry, so as to increase the animal combustion and produce fever, *contagious or infectious fever*, which will last so long as the cause of the disturbance remains in operation. Such fever may, in some instances, subside from reduction of the cause, and then break out again as the cause is reproduced, or it may by its violence, either before or after the cause has

ceased to operate, give rise to a destruction which renders death inevitable. If the body be exposed to agents which modify the vascular tension so that through the vessels the blood shall pass with undue friction, there may be an increase of fever which might be called *frictional fever*. Or, if the tension of the vessels be suddenly reduced by some agent, say alcohol, or cold, so that the heart shall intensely inject the minute vessels with blood, there may again be, from the reaction, an increase of temperature, *fever of reaction* or *congestive fever*. Lastly, if the body be subjected to the influence of some agent which, interfering for a time with the animal chemistry, causes a development of fever, then ceases to act, as if it were itself destroyed, but after a time is reproduced and sets up once more the increase of temperature, there is excited what is known as *recurrent*, *relapsing*, *intermittent*, or *hectic* fever.

Thus it will be seen that the word fever indicates a condition of the widest significance, while in itself it is not strictly speaking a disease. It is an exalted state of that natural function by which all the flexibility of life, the chemistry of life, the construction of matter into living form, the destruction and removal of matter in dead form, is regularly carried on. In fever, the body is, in short, living out of its compass, and wherever in these pages the term fever is used, let it be remembered as meaning fire,—over-action,—expenditure beyond the natural capacity of vital process.

Irritation.

The term irritation is applied to express a condition in which some sensitive surface richly supplied with nerves is subjected to mechanical or chemical injury. The effect produced on the surface of the eye by the introduction of some small foreign body, like a grain of sand between the lids and the eyeball, is a familiar illustration of irritation. We may say, as a general rule, that the effects of irritation are always confined to membranous surfaces; as to the skin or cutaneous membrane; to the mucous membranes of the eye, the alimentary canal, the bladder and its passages; to the serous membranes enveloping the heart, the lungs, the intestines; to the membranes enveloping the brain and nerves; to the membrane which covers the bones, the periosteum; to the nervous membranous expanses like the retina or receptive surface of the eyeball.

When a membrane is irritated, in addition to the pain which is produced, there is an effect also on the blood-vessels. The vessels, seeming to lose control over the current of blood that should be passing through them in measured and self-adjusted quantity, become overcharged with blood, or, as it is said, congested and dilated. If the part affected be in nervous commuuication with a secreting gland, the gland is influenced, and pours forth a too abundant secretion. And, finally, in regard to local effects, if the irritation be continued, changes take place which are usually inflammatory in character.

Irritation, as a local condition, is therefore attended with many inconveniences and dangers, but the mischief does not always stop at what is local. Owing to the intimate intercommunications between one part of the body and other parts, by means of nervous fibres, and owing to the fact that vibrations communicated to irritated parts may easily be conveyed along nervous fibres, from the circumference to the nervous centres themselves, it constantly happens that by irritation in one part of the body a disturbance of action communicated to a nervous centre is reflected from that centre, through other nervous fibres that are directly or indirectly connected with it, to some remote part which is thereby affected. An illustration of this is offered in the case of convulsions from an irritation in the intestinal canal. It happens frequently in infancy, and occasionally in later life, that a foreign substance in the stomach is a cause of convulsions of a general character. Here the irritation communicated to the nerves of the stomach is carried to the motor part of the spinal cord, and from thence is reflected along the motor tract of nerves to the muscles which they supply with the stimulus to excite contraction, and with the result of exciting uncontrolled convulsive movements in the muscular organs.

Irritation may therefore produce four distinct phenomena. (*a*) Pain; (*b*) congestion of blood-vessels, leading towards inflammation; (*c*) over-secretion; and, (*d*) convulsive muscular movement. Further, it may produce a general febrile condition, and as a producer of one or more, or all of these changes, it deserves to be remembered and understood whenever it is named in relation to disease.

Agencies producing irritation are called irritants. They may be purely mechanical, like a grain of sand, or chemical, like the

vapors of ammonia or turpentine. Their mode of action is not so clearly understood as their course of action, but it is probably by the setting-up of vibration in nervous matter, through an ethereal medium or nervous atmosphere.

Catarrh.

When under irritation there is an excessive flux or discharge from any secreting or excreting surface of the body, the term catarrh is employed to express the fact. This term indicates that the natural secretion or excretion is being thrown off in excess. In common cold there is an excessive secretion from the nostrils, and what is called *nasal* catarrh is presented. When there is discharge of mucous fluid from the bladder *vesical* catarrh is said to be present. When there is free secretion and expectoration of phlegm from the bronchial tubes, without inflammation, *bronchial* catarrh is said to be present. The condition is what the word describes; it is an outpouring or defluxion.

Inflammation.

Inflammation is one of the most common conditions of disease, and from oldest times the term, like the term fever, has been in common use. The question whether there can be fever without inflammation is, in fact, one of the oldest problems in medicine, dating even from Erasistratus. Inflammation is understood to mean a change in an organ or part, attended with four distinct phenomena, "rubor et tumor, cum calore, et dolore": redness and swelling, with heat and pain. As a picture of phenomena nothing more accurate has ever been given. When any part is *red* and *swollen*, with *heat* and *pain*, it is inflamed. The condition leading to this state is one of preceding irritation, and the phenomena observed are all indications of a derangement between the nerves and blood-vessels. The vessels are dilated with blood, and the surrounding loose tissues swollen; the nerves are painfully compressed; the whole of the affected part is raised in temperature,—it may be above the temperature of the rest of the body;—and, the injected parts are red.

All portions of the body that are supplied with blood-vessels and nerves are subject to inflammation, so that there is an immense number of inflammations, as many, in fact, as there are organs, or even of parts of some of the more complicated organs.

To give one example: the eyeball alone is subject, in its various parts, to six distinct acute inflammations.

Inflammation, besides being considered in respect to local structures and organs, has also to be considered in regard to certain characters of the condition itself. If the inflammation of a part be connected with some particular state or condition of body by which its own phenomena are modified, the particular constitutional state is described, adjectively, to express the connection that has occurred. In this manner peculiar forms of inflammation are quoted, of which the following are specially given in the scientific nomenclature.

Pyæmic Inflammation.—An inflammation occurring during the existence of the diseased state called pyæmia or pyæmic fever. In pyæmia, which follows often on a wound or after an operation, there is a state of the blood inclining it to coagulate within the body, and to arrest its circulation in the visceral organs, by the clot which is formed from the coagulation. The presence of the obstructing clot causes irritation and inflammation, which is then called pyæmic inflammation.

Rheumatic Inflammation.—Inflammation connected with the rheumatic condition, and sometimes of a flying character during the attack of disease. The inflammation affects different organs of the body, or one or other of the joints, or the coverings of the heart, or the valvular structures of the heart.

Gouty Inflammation.—Inflammation connected with a gouty condition of body and developed in some local parts during the gouty state, and especially in some particular part, as the great toe. This inflammation, like the rheumatic, is often transitory in character, and moves from one organ of the body to another, by what the older writers designated, metastasis, or transference of disease.

Syphilitic Inflammation.—Inflammation associated with and taking its inclination from the specific contagious disease known as syphilis.

Scrofulous Inflammation.—Inflammation connected with the general condition and feebleness of body recognized, commonly, as struma, scrofula, or,—once on a time,—king's evil. The inflammatory state in persons of scrofulous taint is easily excited, is often of a low, or "asthenic" type, and is prone to invade the glands of the body, and especially the glands of the neck.

Gonorrhœal Inflammation.—Inflammation connected with the contagious disease, gonorrhœa.

Inflammation finally gives origin to certain changes in the parts to which it has been confined, which changes have received also particular names. To three of these, owing to their frequency, special reference must be made.

Ulceration.—When from acute or slow inflammation a structure, such as the skin or a mucous membrane of the body, is locally destroyed on the surface, so that there is left an open sore which will only heal by contraction of its edges and formation of raised points or granules, the part is said to have ulcerated, and an ulcer is said to have been formed. If the tendency of an inflammation is towards this state, *ulcerative inflammation* is the term used to define the condition of disease.

Suppuration and Abscess.—If the result of inflammation be the formation in the inflamed part of the white, creamy-like fluid called "matter," or "pus," the terms suppuration and abscess are used to explain what has occurred, and the inflammation is said to be *suppurative.* When the formation of matter is circumscribed and is confined to a small spot, with a tendency to break through and escape at some point where there is least resistance, the term *boil* is ordinarily used to describe the change. When the accumulation of matter is large, *an abscess* is said to have been formed.

Plastic Exudation.—When in the course of an inflammation there is thrown out of the blood-vessels, from the blood, a portion of the fibrinous, sizy, or plastic part of the blood, and when that plastic fluid, in the course of after changes, instead of being reabsorbed into the blood, is solidified and causes adjacent parts to be held together or condensed, *plastic exudation* is said to have occurred, and the term *plastic* is used to define the inflammatory condition. In the membranous cavities, such as the pleural cavity of the chest, plastic exudation may bind the pleural surfaces together. In the cavity of the abdomen plastic exudation may form bands around the intestines. In the structure of organs, such as the lungs, plastic exudation may infiltrate into the loose connecting tissue, and may even become the basis of new growths. In all these cases, and in others of a similar kind, in different parts of the body, the inflammation is said to be plastic in its character.

Gangrene, Mortification.

When an organ or structure ceases to live, either from deficiency in its supply of blood or from deficiency of its nervous supply, and when, so changed, it begins to darken and to give off offensive gases, the term *gangrene*, or *mortification*, is used to express the diseased condition.

Congestion.

When in an organ or part richly supplied with blood,—such as the lung, the brain, the liver, the kidney, a serous membrane, a mucous membrane, or the skin,—the blood, flowing through the organ or part, stagnates and accumulates, the organ or part is then said to be suffering from *congestion*. The congestion may be active or passive.

Extravasation.

When in an organ or part there is poured, into its structure, a quantity of blood which has escaped from the blood-vessels that naturally supply it; and when the blood,—instead of flowing on in due course, yielding to each part the material necessary for its sustainment, and taking up the used materials,—is mechanically diffused in the structure of the part, the structure is then said to be subjected to *extravasation of blood*.

Hemorrhage.

When the blood having escaped from its vessels, flows away from them, *hemorrhage* is said to have occurred. If the blood is slowly oozing away the hemorrhage is said to be passive. If the blood flows in a steady stream, or if it spurts out in a jet, the hemorrhage is said to be active.

Dropsy.

When the watery part of the blood exudes too freely into a cavity of the body,—such as the pleural cavity of the chest, the pericardial cavity of the heart, or the peritoneal cavity of the abdomen,—and when the fluid accumulates in such cavities, the term *dropsy* is employed to designate the condition. When the watery fluid accumulates in the cellular or connecting tissue of the body so as to cause the skin to be raised and tense, and the feet

or other parts to be swollen, the same term, *dropsy*, is still employed to express the condition. The word *anasarca* is also used to express this last-named dropsy.

Fibrinous Deposition.

During life the healthy blood contains 2.50 in the 1000 parts of a substance called fibrine. This substance is the plastic part of the blood, and in the blood stream it is in the fluid state. Drawn from the body it coagulates and becomes solid, forming the blood clot. In some conditions of disease this fibrine separates, within the body, during life. It may separate as a coagulum or clot in the heart or blood-vessels, portions of which clot may be carried into the circulation and may close up the smaller vessels. It may separate in the structure of very vascular organs. When such separations occur the term *fibrinous separation or deposition* is applied to express the diseased state.

Dilatation and Contraction.

When different organs or parts of the body are subjected to strain or to irregular work they change in their dimensions, and to these changes different terms are applied. When a hollow structure,—such as the heart, or an artery, or a vein,—is distended without being enlarged in its own structure, it is said to be suffering from *dilatation*. When, on the other hand, it is reduced in calibre, it is said to be suffering from *contraction*.

Hypertrophy or Enlargement.

Sometimes it happens that an organ or part is increased in size, throughout its entire substance, beyond what is natural. A common illustration of this state is shown in the muscles of the working, or hammer-arm of the blacksmith. To this condition of enlargement the term *hypertrophy* is applied.

Atrophy or Wasting.

An organ or part of the body may undergo just the opposite change from that described under the head hypertrophy. It may become smaller, from having wasted, under which circumstances the word *atrophy* is used to express the change that has been produced.

The words, dilatation, contraction, hypertrophy, atrophy, are

of common use in the literature of disease, and their general meaning should be carefully remembered. The terms may be applied to any organ. Thus in diseased conditions of the heart, to cite a common example, the heart may be dilated, contracted, hypertrophied, or atrophied.

Degenerations of Organs and Parts.

The organs of the body, the more active especially,—though none are actually exempt,—are apt to undergo actual change of structure, so as to have their minute and elementary structure transformed into new and unnatural structure, the function of the organ being thereby deranged. When these changes occur the word *degeneration* is generally employed to express the change. The degenerations are rather numerous, and they are very important in relation to life. Without being detected or known by the person subjected to them, they are often in progress until they have so far advanced that life is reduced in value, or is even suddenly cut off, in the midst of apparent health. The principal degenerative changes are as follow :—

Fatty and Calcareous. Atheroma.—A change of structure most commonly occurring in the heart and arteries, and consisting of a degeneration of the structures into a peculiar fatty and calcareous, or petrifactive, condition. To this the term *atheroma*, or *atheromatous condition*, is technically applied. The structures affected are rendered very brittle and are easily ruptured. Apoplexy, from the rupture of a vessel, is often due to atheroma.

Ossification.—A change developed in the arterial vessels, but not specially confined to them, and consisting of a transformation of active or even elastic structure into inactive bony substance. This change may extend to other parts than the blood-vessels. It may affect the membranes and the muscular structures.

Fibroid Degeneration.—In certain structures of the body, the lungs particularly, the elastic connective tissue becomes firm, hardened, and fibrous, causing condensation of structure, and, it may be, compression of neighboring tissues. To this change the word *fibroid degeneration* is applied.

Lardaceous Amyloid or *Waxy Degeneration.*—A change in which the structure of important organs,—such as the liver,—undergoes a transformation into a lardaceous waxy condition. This is called the *lardaceous amyloid* or waxy condition of disease.

Fatty and *Granular Degenerations.*—Sometimes active organs,—such as the heart and other muscles of the body, the brain, liver, or kidney,—undergo a fatty transformation which renders them liable to tear or rupture, and which greatly impairs their active power. These degenerations are of two kinds, one *fatty*, in which the elementary parts of the muscle or the cells of the affected organs or centres are transformed into fatty elements; the other *granular*, in which the natural elements are changed into a granular fatty state, and lose their ordinary functional capacity. These changes become most important when they affect the heart, the liver, or the brain and other portions of the nervous system. They invariably lead to failure of action on the part of these vital organs, and, as affecting the heart, are frequent causes of sudden suspension of function, of faintness, and even of death.

Cirrhosis.—Under various influences,—the influence of alcoholic drinks particularly,—in addition to many of the above-named induced changes of structure, there is one particular change of condition to which the liver is especially liable. The connective tissue of the organ is hypertrophied and hardened, and the compressed secreting cells are charged with a yellow coloring stuff or pigment. To this condition the term *cirrhosis* is applied.

Pigmentation.—A degeneration is occasionally met with in which the minute elementary cells of parts or organs are charged with dark pigment. This change has been known to commence on one place in the skin and to extend over the whole of its surface, producing an actual dark or black skin. The phenomenon is extremely rare.

Specific Degenerations.—The different organs and tissues of the body are sometimes affected with special constitutional changes which mark off forms of local disease, also called degenerative. Changes from *syphilitic diseases*, from *cancer*, and from *colloid*, *i.e.*, gelatinous growth, are of this kind. *Scrofulous* degenerations,—with and without the specific condition of true phthisical or consumptive affections, *tubercle*,—come under this head.

Tumors and Cysts.

The organs and parts of the body are liable to become the seats of growths which are not necessarily malignant or fatal in character, though they may give rise to inconvenience, and, indi-

rectly, to serious or fatal obstructions or pressures. Such growths are called *non-malignant tumors*. Analogous, in some respects to them, are other growths which contain fluid or cheesy-like material within them, and which are called hollow or encysted tumors, or cysts. The growths which are often seen on the exterior of the body, which occasionally grow to a large size, and are vulgarly called "wens," are of this encysted or cystic character.

Calculus.

In some of the open cavities of the body, as in the gall bladder, in the urinary bladder, and in the intestinal canal, there are formed, in some persons, hard, separate, loose masses, which, taking somewhat the character of stones or pebbles, are called *calculi—calculus*, a pebble. In the gall bladder they usually consist of a fatty substance,—cholesterine. In the urinary bladder they consist of earthy bases combined with an animal acid, or of an insoluble animal acid itself, condensed on a foreign body which acts as a nucleus. In the intestine they consist generally of some foreign substance which has been swallowed in large quantities, such as magnesia, and which, failing to pass along the intestine, has entered into a concrete or solid mass.

Malformation.

Amongst the local diseases affecting particular organs and parts of the body, is included, in scientific nomenclature, what is called *malformation* of organs, some error of natural construction by which the proper working of the organic structure is impeded or perverted. A good illustration of this is supplied in those who are born with a defect in the partition wall which separates the right from the left side of the heart in the auricular cavities of the heart. When this malformation occurs, the venous blood on the right side of the heart, which, naturally, should all pass over the lungs to be oxidized, is allowed, before it reaches the left side, to pass, in part, directly from the venous into the arterial side of the circulation, and so to circulate over the body as a blood imperfectly arterialized. The blood in this state is of a dark or venous color, and the blue condition of body which is present gives origin to the term *cyanosis* as descriptive of the condition. This is only one *malformation*, but it is perhaps the best that could be offered for the purposes of practical illustration.

Parasitic Conditions.

There is another state of the corporeal organs or structures in which the change which constitutes the condition of disease is due to the introduction of new forms of animal life which multiply, and by their presence and multiplication create local, and, from the local, general, derangement of the body. To these manifestations of disease the term *parasitic* is applied. One common illustration of parasitic affection is offered in those who are suffering from intestinal worms; another is supplied in those who are suffering from scabies, vulgarly, itch, in whom an insect, the *Sarcoptes scabiei*, burrows under the skin and keeps up a constant eruption and irritation.

Cachexia.

Literally a bad state of body. The term is used to describe, without any particular definition of disease, a condition of feebleness, a depression of a physical, or, of a physical and mental character. The term is often applied to people of scrofulous constitution. It is applied also to persons who have become reduced in health from confinement in close air, from overwork, or from indifferent diet. It is applied again to those who have long been subject to slow and exhausting diseases. It is sometimes used to define the bloodless condition more correctly expressed as anæmia.

Collapse and Syncope.

The word collapse is applied to a condition in which the powers of life are rapidly sinking, the body prostrate, the abdomen shrunken, the limbs helpless, the face contracted, the expression vacant, the mind listless or unconscious, the external surface cold, and the respiratory muscles and heart failing in their action.

When the bodily and mental powers suddenly collapse, faintness or syncope is said to have taken place.

Functional Derangement.

An expression employed to define a class of disorders, as yet very obscure in their nature, in which the organs of the body are moved to manifestations of disease without being themselves actually changed in structure. The affected organs may seem, to all appearances and to all present modes of physical investigation,

to be healthy, but may, nevertheless, be performing their duties in an imperfect or irregular manner. They often, under these circumstances, regain their natural powers altogether. When an organ itself seemingly perfect and capable of regaining its orderly life and action is under this irregular action, it is said to be *functionally* disturbed, and the phenomena of disease caused by its aberrations are held to be *functional* disorders, as distinct from positive organic diseases. The distinction is, as a rule, vital in its meaning, inasmuch as the most alarming symptoms of a functional character may be of lesser moment than a comparatively light series of symptoms springing from actual organic change. The skilful physician is, therefore, ever on the watch to detect the difference between symptoms dependent on functional aberrations and symptoms dependent on organic changes. The functional disorders are, generally, of nervous origin, and are dependent on a disturbance of the nervous atmosphere or nervous function of the organ affected, not on structural disease of the organ itself. The derangement is as from a storm passing through the structure and temporarily modifying its action, not from physical change of the structure.

Debility.

The College authorities define the technical application of the term debility as intending to express an "uniform exhaustion of all the organs of the body without specific disease." The definition is, perhaps, as complete as can be supplied in our present state of knowledge, and many deaths are registered every year in this and other countries as from debility. The term is more commonly used to express the intermediate condition between an attack of acute or exhausting disease and the return to the natural state. Debility is sometimes defined as *asthenia*.

Coma.

Literally a profound or deep sleep. A condition of disease in which the body lies unconscious, insensible to all external impressions, and incapable of being roused from the torpor.

Asphyxia.

Suffocation. A condition in which the respiration is checked, —as during strangulation,—and the body is rendered cold and

dark from obstructed aëration of the blood. By asphyxia, coma, asthenia, or syncope, death ordinarily supervenes.

Natural or Senile Decay.

Natural or senile decay is that condition in which the bodily powers pass into helplessness and the mental powers into second childishness and mere oblivion. The condition is one in which the elastic structures of all the organs of the body have lost much of their resilience; the muscular structures have shrunken; the cartilages have been transformed into bone; the bones have become condensed; the skin has shrivelled and become dry; the hair has become gray or has fallen off; the gums have atrophied; the teeth have fallen out or decayed; and the cells of the nervous system, locked up, as it were, in the now firm connective tissue, or nerve-cement, are all but dead to motion. In this state death at last takes place as in a sleep, the one only natural mode of dissolution.

CHAPTER III.

GENERAL DISEASES RUNNING A DEFINITE COURSE.

1. THE GREAT PLAGUES.

In the nomenclature of the Royal College of Physicians, on the lines of which, with few exceptions, I, as a rule, proceed, the *general* diseases that affect mankind, as apart from the *local* conditions of disease, are divided into two grand classes: namely, into diseases which run a definite course, and take, some of them, an epidemic or spreading character: and into diseases which are not spreading, but are of a constitutional and often of an hereditary nature. I propose in the present chapter to state the diseases of the first of these classes, the epidemics or great plagues. They are defined, authoritatively, as follows:—

Diseases "which appear to involve a morbid condition of the blood; which, for the most part, but not all of them, run a definite course; are attended with fever, and frequently with eruptions on the skin; are more or less readily communicable from person to person; and possess the singular and important property of generally protecting those who suffer them from a second attack." These diseases have each a period, between the time when they are first contracted and the first appearance of eruption or other symptom, which is called *the period of incubation.* Some of these diseases have also what is called a critical day or *crisis*, upon which the patient either begins to succumb or commences to recover.

The diseases of this class are thirty-seven in number. They are, emphatically, the great plagues. They are all dependent for their development on some particular poisonous agent which is generally communicable from the affected to other susceptible persons.

SMALL-POX. VARIOLA.

An extremely contagious affection, marked by an eruption over the body containing matter or pus, and called pustules. The period of incubation is twelve days. The crisis is about the eighth day of eruption, but is not very definite.

Varieties.

Distinct.—Each pustule of the eruption distinct.

Confluent.—Pustules very numerous and running together over the surface of the body.

Semi-confluent.—Pustules running together in parts.

Abortive, *varicelloid.*—Minor small-pox. Few pustules, and those little more than vesicles,—little bladders,—containing watery fluid.

Petechial.—Called, vulgarly, black or putrid small-pox, dark blood being effused into the pustules.

Hemorrhagic.—Small-pox with blood in the pustules, with a tendency to bleeding from the mucous membrane of the intestinal canal.

Corymbose.—The disease with the pustules running in clusters like bunches of grapes.

COW-POX. VACCINA.

A disease induced in the human subject by the process of vaccination. A modified form of small-pox, in which a cow-pox vesicle on the udder of a cow or heifer is the common original source of the infecting matter. A disease attended, as a rule, with no further eruption than the vesicle or pustule at the points where the matter is inoculated; communicable by inoculation, but not otherwise; mild in its course, and yet, generally speaking, protective against small-pox. The period of incubation is from two to three days. The crisis is about the eighth day.

CHICKEN-POX. VARICELLA.

A disease attended, like the small-pox, with a vesicular eruption, which may become pustular. The spots of the eruption usually lie far apart, and are confined to the trunk of the body. In bad forms varicella so closely resembles small-pox as to require skilled medical knowledge to distinguish it. The disease is

attended with some fever, but is hardly ever fatal, and rarely leaves pits or marks on the body. It is not prevented by vaccination, and it is not protective against small-pox. It is also doubtful whether small-pox is protective against it. It is not communicable by inoculation. The period of incubation is from ten to twelve days. The crisis is about the fifth day of the eruption.

Measles. Morbilli.

A common and well-known eruptive contagious affection common to the young, and occurring in all parts of the world into which it may be imported. The disease is attended with a general red measly eruption and fever, preceded by symptoms of catarrh or cold in the eyes and nose. Under conditions favorable for recovery it is not generally fatal, but it becomes very fatal under unfavorable conditions. The period of incubation is from ten to fourteen days. The crisis,—not very definite,—is about the fourth day of the eruption.

German Measles. Rötheln. Rubeola.

A contagious mild disease, attended with slight fever, sore throat and measly oval-shaped red eruption. The affection, which usually commences with catarrh of the nose and eyes, presents mixed symptoms of measles and of scarlatina. The period of incubation is from four to six days. The crisis is on the second or third day of the eruption.

Scarlet Fever. Febris rubra.

A very contagious and often fatal disease, marked by a universal red rash over the body with high fever, strawberry tongue, and with redness and, sometimes, ulceration of the throat. The period of incubation is usually considered six to eight days, but may be not more than as many hours. The natural crisis is about the fifth day of the eruption, but is often prolonged by complications.

Varieties.

Simple Scarlet Fever.—Commonly called *Scarlatina.* The rash on the body is well marked, and the throat is very red but is not ulcerated.

Anginose Scarlet Fever.—A more severe type; the throat is

red, swollen, and ulcerated, with formation, sometimes, of abscess in the neck.

Malignant Scarlet Fever.—Scarlet fever in its most rapid and fatal form. In this variety the throat becomes covered with a slough from quick decomposition of the mucous membrane; the eruption on the skin is dark; the fever intense; the external glands of the throat are much enlarged; and, the prostration, sudden and severe, is attended often with convulsive movements of the limbs, with insensibility, coma and death. As a general rule the malignant form of scarlet fever is developed from the onset, and it may be said, generally, of each variety that, with rare exceptions, each maintains its own character and runs its own course. This is true of epidemics as of individual instances of the disease. At the same time all the varieties are contagious, and one may be caught from the other, the severe form from the milder form, the milder form from the severe, or the like from the like. Constitutional peculiarity seems to determine the type which the disease will assume.

Sub-Varieties.

Doubtful Scarlet Fever. Rosalia Idiopathica.—A disease described originally in my *Clinical Essays*, in which a scarlatinal eruption occurs with some fever, soreness of the throat, and strawberry-like tongue. The disease is transient in character, does not spread, and apparently is not contagious. The period of incubation is probably from one to two days. The crisis is on the second day of the eruption. The disease is not known to be fatal.

Rheumatic Scarlet Fever.—A mixed condition of rheumatic and scarlet fevers,—also defined in the *Clinical Essays*,—in which, with the symptoms either of simple or of anginose scarlet fever, there is acute rheumatism of the joints. The scarlatinal element of the disease is contagious. The period of incubation is the same as of scarlet fever. The crisis is rendered indefinite by the frequent recurrence of rheumatic complications.

Dengue. Dandy Fever.

A febrile contagious disease, attended with rheumatic symptoms and with an eruption resembling measles. It occurs in the West Indies and in some other hot or tropical climates. The

period of incubation is short, probably not more than three days. The crisis is rendered indefinite by the recurrence of rheumatic symptoms.

Cerebro-spinal or Tetanoid Fever.

Cerebro-spinal fever is sometimes called malignant purpuric fever; or epidemic cerebro-spinal meningitis. More recently it has been named by Dr. Rosenstein, and as I venture to think most correctly, *tetanoid fever*. It has been known to occur in England. It is marked by a dark eruption, intense fever, delirium, and tetanic spasms. It is very fatal. The periods of incubation and of crisis are not determined. It is probably not contagious.

Typhus Fever.

A continued fever attended with a dark mottled rash on the body, great nervous prostration and delirium, but without any specific affection of the bowels. The disease is very contagious, and very fatal. The period of incubation is, in most cases, from ten to twelve days. The crisis is about the fourteenth day after the eruption.

Typhoid or Enteric Fever.

Typhoid or enteric fever, called also gastro-enteric,—owing to the circumstance that in it the stomach and intestines are seats of disease,—is marked by a rose-colored rash on the skin, high fever, delirium, and much disturbance of the bowels. Until comparatively modern days typhus and typhoid fevers were confounded together as one disease, in the same way as measles and scarlet fever once were. Typhoid is now known as a distinct affection, and is distinguished from typhus by the occurrence of special intestinal derangement as well as by the eruption. It is not so readily contagious as typhus. The period of incubation ranges from six to fourteen days. The crisis is about the fourteenth day after the eruption. Typhoid, owing to its common connection with bad drainage, has received the vulgar but expressive name of "drain or cesspool fever."

Relapsing or Famine Fever.

A fever which breaks out in ill-fed, badly-housed, or rather closely-housed communities. In some respects it resembles ty-

phus, but differs in the absence of an eruption and in the circumstance that the onset is direct, *i.e.*, without preliminary signs, and that the febrile attacks, usually of short though severe duration, pass away leaving the person comparatively well. After an interval of about seven days the attacks recur, the relapse taking place, it may be, four and even five times. The disease is less fatal than typhus fever, but recovery from it is often much more prolonged. It is extremely communicable, and attacks those who are well fed if they be exposed to its influence. It is connected with famine in its origin, but seems also to require impure air for its development. The period of incubation is from five to seven days. The period of crisis is indefinite.

Febricula.

A minor fever, in which the person affected is for three or four days feverish without showing any signs of eruption on the skin or any indications of inflammatory disease, recovery being rapid and complete. The disease can hardly be called communicable, though it may be epidemic. The periods of incubation and of crisis are indefinite.

Continued Fever.

Simple fever, without eruption, inflammation, or other specific sign that would link it with any of the specifically contagious febrile diseases. It differs from simple febricula by its longer continuance. In past days physicians included many of the now well-defined fevers under the term continued fever, making it almost a general term to describe a fever that was of long duration. The periods of incubation and of crisis are undefined.

Yellow Fever.

"A malignant epidemic fever, usually continued,—but sometimes assuming a paroxysmal type,—characterized by yellowness of the skin, and accompanied, in the severest cases, by black vomit, hemorrhage from the stomach, nose and mouth." This is the terse description of the disease by the Royal College. It is peculiar to tropical climates, and does not spread in a temperature below 72° F. It is extremely fatal, perhaps communicable, and decidedly epidemic. The period of incubation is indefinite,

but probably not more than four days. The period of crisis is from six to eight days.

Plague.

Plague is defined as "a specific fever, attended with bubo, 'boil,' of the inguinal glands of the groin," and other glands, and "occasionally with carbuncles." It is the pest or pestilentia, black death, of the old writers, and at one period it invaded this country, though it has always been chiefly confined to Eastern countries. It is easily communicable and extremely fatal. The periods of incubation and of crisis are very short, two to eight days, but have not been definitely assigned.

Ague. Intermittent Fever.

A disease attended with paroxysms of severe fever, followed by intermissions of the febrile condition during which the sufferer, though he may be enfeebled, is comparatively well. The paroxysms are signalized by three stages, called respectively the *hot stage*, in which the fever may rise to 105° F.; the *sweating stage*, in the course of which, owing to the profuse loss of water from the body, the fever is reduced and the temperature brought down; the *cold stage*, in which the body is reduced in temperature to the natural 98.4°, and sometimes to a little below what is natural. The paroxysms thus developed recur with considerable regularity, not in all cases in the same order of time, but in the same case after the same order. Thus, in one case the paroxysm will recur daily, in another every third day, in another every fourth day,—in regular order. This has led to the enumeration of several varieties of the disease.

Quotidian, where the fit occurs every twenty-four hours while the disease lasts.

Tertian, where the fit occurs every forty-eight hours while the disease lasts.

Quartan, where the fit occurs every seventy-two hours while the disease lasts.

Irregular, in which the paroxysms are not distinctly periodical. Under this head the College includes the periodical neuralgia which is called brow ague.

In quotidian ague, the fit is most prolonged; it may last for sixteen hours during the three stages. In the tertian variety the

fit is of shorter duration, ten hours. In the quartan the fit is of shorter duration still, namely, six hours. Ague was once a common disease in England, and even in London. The great Lord Protector, Oliver Cromwell, succumbed to it, and in the time of His Highness and long afterwards the physicians had much practice from it. It declined in this country from two causes, from the drainage of fenny and marshy districts, and from the introduction of Jesuit's bark,—cinchona,—for its treatment. The disease seems to be entirely due to some miasmatic marshy poison which, disposed of largely during the paroxysm, re-forms in the body in the course of the interval of remission and reproduces the attack. The period of incubation is from one to fourteen days. The crisis in each fit is defined above. The general crisis is undetermined.

Remittent Fever.

A fever occurring occasionally in this country, but more frequently in warmer climates, in which, with paroxysmal attacks of high fever, as in ague,—but at less regular intervals,—there is a yellowness of the skin something like that which characterizes yellow fever. The disease in temperate climates is sometimes called "bilious remittent," and in tropical climates malignant remittent fever. It is rarely fatal in the milder forms of it, and is of local or endemic character, depending upon some malarious cause. It was remarked to me thirty years ago by an old practitioner, who in the fen districts had, in his early life, seen much of ague, that on cessation of that disease bilious remittent fever, which had also been common, remained much longer as a local disease. There are no definite periods of incubation nor of crisis.

Simple Cholera.

Cholera, or relaxation of the bowels, with or without vomiting. The disease occurs in this and in other countries with a certain degree of seasonal regularity, and is marked by a copious loss of fluid from the intestinal canal, with, in bad cases, cramps in the bowels and limbs and coldness of the body, followed, during recovery, by reactive fever. The affection, which is not contagious, occurs at times epidemically, and is not infrequently fatal. From its common appearance in the autumn, it is sometimes called autumnal cholera. It is usually excited by indulgence in

some form of indigestible foods, such as unripe fruits, but there is, at the same time, a presiding influence promoting the tendency, which is probably atmospheric, but which is not as yet defined by scientific research. The period of incubation is usually short, not more than a few hours. There is no defined period of crisis.

Malignant Cholera.

Specifically, *the cholera.* Called also Asiatic cholera, serous cholera, spasmodic cholera, and defined, graphically, by the Royal College as "an epidemic disease, characterized by vomiting and purging, with evacuations like rice water, accompanied by cramps, and resulting in suppression of urine and collapse." The disease is of Eastern origin, but has travelled over the temperate, and to some extent into the arctic zone. It is apparently communicable, seems to follow the courses of great rivers, and, according to the modern view, first advanced by the late Dr. Snow, the poison of it is conveyed mainly by water. It is extremely fatal, and attacks people of all ages, but men more frequently than women. Occasionally, it takes a *sporadic* form, breaking out, that is to say, in scattered places and then ceasing, without pursuing a definite course. The period of incubation is short, often not exceeding five or six hours. The crisis is indefinite.

Diphtheria.

A disease which in many respects is allied to croup, but which differs from that affection in that it is of contagious character. It is attended with fever, which usually appears to arise from cold and sore throat, but which ends in a specific affection of the throat. In bad cases the windpipe and air-passages become covered with a tough membranous exudation, which may separate like a piece of leather from the mucous surface. Diphtheria is most frequent and fatal in children, but it attacks persons of adolescent and middle life, and it is extremely fatal. There are some persons who seem more susceptible than others to its influence, and there can be no doubt that the tendency to it runs in particular families. Although manifesting itself by the most marked local signs in the throat, it is a general disease in which there is a tendency to separation and coagulation of the fibrinous part of the blood. It is often rendered rapidly fatal by the separation and coagulation of the fibrine of the blood within the heart.

The period of incubation, according to my observation, is from three to six days. The crisis is about the fifth day.

Diphtheritic Paralysis.—Diphtheria is sometimes followed by paralysis of some of the muscles of the body. The palsy affects mostly the muscles used in swallowing, but it sometimes extends to the muscles of the neck, and even to those of the limbs. I have seen it once extend so as to include the whole of the muscles of the right side of the body. It is, I believe, due to a process of coagulation in the nervous fibres. As a rule persons of fair general health recover from it under conditions favorable for recovery.

Whooping-cough or Pertussis.

A disease beginning as a cold and attended with spasmodic cough coming on in paroxysms and often, by the violence of the cough, causing disease of the lungs. It is attended at first with some febrile disturbance, and in all stages it is communicable. At the onset it is apparently confined to irritation in or near the glottis,—the opening into the windpipe. The period of incubation is from four to six days. The crisis is indefinite, but the disease rarely lasts less than five weeks.

Mumps.

An epidemic and probably a communicable disease, affecting the salivary glands. The glands are much swollen and inflamed, and there is a general feverish condition. It is rarely a fatal disease, but is often severely painful. The period of incubation is about fourteen days; that of crisis about four days.

Influenza.

A suddenly developed and intensely severe cold or catarrh, hence sometimes called "lightning catarrh," attended with an extreme nervous depression and violent cough. It is often epidemic or spreading, but is not *proved* to be contagious. Sometimes it suddenly affects a whole community, and in many epidemic visitations has been extremely fatal. The period of incubation is a few hours. The crisis is indefinite.

Glanders.

A contagious disease commencing as a specific inflammation usually of the mucous membrane of the nose and throat, and originating in contagion derived from a glandered horse. In the horse the poisonous matter comes from the mucous secretion of the nostrils, but it may enter the human subject by a wound. The disease is contagious from one affected person to another. The period of incubation is short, from two to four days. The crisis is also short, from four to seven days.

Farcy.

A form of disease affecting man, caused by contagious material passing from a horse, either under glanders or farcy, to man. It is a specific inflammation of the skin and absorbent vessels and glands. The disease is sometimes accompanied by swellings called either farcy buds or farcy buttons. It is communicable from the matter secreted from the sores. The period of incubation is about four days. The crisis is indefinite.

Grease. Equinia mitis.

A form of local pustular disease produced by communication of contagious matter from a horse suffering from what is called "grease,"—inflammation of the sebaceous or grease glands,—to man. The period of incubation is four days, and of crisis or maturation of pustules, eight days.

Malignant Pustule. Charbon.

Another serious form of disease communicated by the transmission of contagion derived from cattle suffering from malignant pustule. The disease commences as a small bladder or vesicle on the skin, and spreads as a gangrenous inflammation which becomes hard and extremely offensive. It is exceedingly fatal. The period of incubation is limited from ten to twenty hours. The crisis is indefinite.

Phagedena.

Phagedena is a condition of wounds in which a slough,—a decomposing or putrefactive surface,—attacks wounds or ulcers and spreads from them. The disease is usually produced in

wounds affecting persons in a bad atmosphere. The periods of incubation and of crisis are indefinite.

Sloughing Phagedena.

A more severe form of phagedena, in the progress of which the putrefactive destructive change not only extends on the surface of the body, but goes deep into the tissues, involving the cellular or connective tissue beneath the skin. The periods of incubation and of crisis is indefinite.

Hospital Gangrene.

A form of "sloughing phagedena occurring endemically, *i.e.*, locally, in hospitals." The disease is developed in hospitals charged with impure air. The periods of incubation and of crisis are indefinite.

Erysipelas. St. Anthony's Fire.

A specific inflammation of the skin, of a contagious character and tending to spread over the surface of the skin. The inflammation sometimes springs up spontaneously, affecting the head and face more frequently than other parts of the body. It is apt to occur from wounds and after surgical operations. It may become epidemic. The period of incubation is about four days; that of crisis is indefinite.

Varieties.

Simple.—In which the inflammation is entirely superficial or confined to the surface of the skin.

Phlegmonous.—In which the inflammation extends below the skin into the cellular or connective structure.

Diffuse.—In which the inflammation, extending into the cellular tissue beneath the skin, diffuses through the cellular tissue.

Pyæmia. Suppurative Fever.

An acute febrile affection resulting in formation of purulent matter and of abscess in the viscera and other parts of the body. Pyæmia follows on wounds, surgical operations, and childbirth. The period of incubation is from four to eight days. The crisis is indefinite.

Puerperal Fever. Childbed Fever.

An acute form of contagious fever occurring in women during or after childbirth, usually a few days after childbirth.

The poison of this fever may be communicated by those who attend her to the childbed woman, and it is so conveyed in many instances. But the disease may probably originate from other poisonous secretions than the secretion derived from a previous specific case. Thus it may occur from contagion of scarlet fever or erysipelas. The periods of incubation and of crisis are uncertain.

Puerperal Ephemera. Weed.

A fever, sometimes called milk-fever, usually occurring in women after childbirth. It is probably not contagious, but may be of malarious origin. The secretion of milk is suppressed, and fever of a short remittent kind follows. The period of incubation is from three to seven days. The crisis is uncertain.

Syphilis.

A contagious disease called sometimes *specific disease*, affecting both sexes, and produced by the inoculation of a poison known as a " venereal " poison. The period of incubation is variable, forty days being the most common period. The crisis is indefinite.

Varieties.

Primary syphilis.—In which the disease is limited, in effect, to the part inoculated with the poison and to the lymphatic vessels and glands,—glands of the groin,—connected with it.

Sub-varieties of primary syphilis :—

(1) Where the part inoculated is swollen and hard, and the glands affected are swollen and indurated ; indurated boil, or bubo.

(2) Where the part inoculated is swollen and soft, and the glands swollen and suppurating ; suppurating boil, or bubo.

(3) Where the part inoculated is a spreading sore ; phagedenic sore.

(4) Where the part inoculated is sloughing or superficially mortifying ; sloughing sore.

Secondary syphilis.—In which the disease extending beyond the part inoculated affects the system generally, causing soreness of the throat, neuralgic and rheumatic pains in the limbs, copper-colored eruption on the skin, and general cachexia.

Tertiary syphilis.—In which the disease, without new inoculation, and after apparent recovery from secondary symptoms, recurs in the secondary form.

Hereditary syphilis.—In which the disease appears in the child in the constitutional form, from taint communicated by its parent; one or other of its parents having been affected with the disease or having inherited it.

Gonorrhœa.

A contagious disease affecting both sexes, and consisting of a suppurative inflammation, yielding a specific poisonous secretion, and sometimes accompanied with swelling in the groin. The disease has an acute and chronic stage, the chronic or prolonged stage being commonly called gleet. The period of incubation varies from three to nine days. The crisis is indefinite.

Gonorrhœal inflammation, when it is present, is apt to produce three specific inflammations, designated respectively:

Gonorrhœal Ophthalmia, a specific inflammation of the conjunctiva or mucous covering of the eyeball.

Gonorrhœal Iritis, a specific inflammation of the iris or curtain of the eyeball.

Gonorrhœal Rheumatism, a specific rheumatic fever occurring during the presence of gonorrhœa.

Hydrophobia.

Literally a disease marked by fear of water, *hudōr*, water, and *phobós*, fear. Actually, one of the communicable diseases depending upon a specific poison secreted by certain animals, the dog particularly, while in a state of rabies, fury. Both terms, hydrophobia and rabies, are unfortunate. As a rule the disease is communicated by the bite of the rabid animal, the poison being in the saliva of the animal, and the wound made in the person bitten being the receiving surface. The symptoms are those of painful dread on hearing the motion of water and other similar sounds; frenzied terror; difficulty of swallowing; convulsions

proceeding to tetanus; copious secretions of saliva; and, death from exhaustion or from spasmodic seizure of the muscles of respiration. The period of incubation varies. The symptoms may appear within a few days or even a few hours after the inoculation, but the time is varied from those short intervals to the longer one of weeks and months, and in rare instances of two and even three years. The crisis is from the third to the fourth day after the first appearance of the symptoms.

CHAPTER IV.

GENERAL DISEASES OF CONSTITUTIONAL TYPE.

The diseases enumerated in the nomenclature of disease, under the second section or division of General Diseases, are distinguished from those of the first division by their longer persistence, their possible recurrence in the same person, and their constitutional and hereditary character.

These types of disease are defined in the nomenclature of the Royal College as :—

" Diseases for the most part which are apt to invade different parts of the same body simultaneously or in succession. They are sometimes spoken of as constitutional diseases, and they often manifest a tendency to transmission by inheritance."

The diseases may be described in the following order.

Acute Rheumatism.

A specific disease, attended with fever and characterized by inflammation of the fibrous tissues surrounding the joints, but without tendency to the formation of matter. Many joints may be affected in the course of an attack at the same time or in succession.

Acute rheumatism is attended with a free secretion of acid fluid from the skin, the acid being of the kind known as lactic. In my experimental researches I have shown that this acid has the power of producing the symptoms of the disease. Rheumatic disease of the heart is a common result of acute rheumatic fever. The affection is hereditary.

Varieties of Rheumatism.

Subacute Rheumatism.—A less acute form of the disease, but attended usually with some fever and much pain.

Gonorrhœal Rheumatism.—A specific form of acute rheuma-

tism, often very severe, and attended with severe febrile disturbance and with pain and swelling in the joints. A disease connected with and probably dependent on the specific disease which precedes its occurrence.

Synovial Rheumatism.—Rheumatism of the joints with accumulation of serous or watery fluid in the synovial sacs or investing membranous pouches of the joints in which the lubricating synovial fluid is secreted. The disease is attended with much local swelling of the joints and pain, but with less inflammation and fever than occurs in acute rheumatism.

Muscular Rheumatism.—A form of rheumatism affecting the sheaths, or fibrous coverings of muscles, and giving rise to pain, increased greatly by motion, throughout the muscular structures. There are two sub-varieties of muscular rheumatism :—

Lumbago, or rheumatism of the muscles of the back.

Stiff neck, or rheumatism of the muscles of the neck.

Chronic Rheumatism.—Rheumatism in which the pain is continued chiefly in joints, and attended with " stiffness and swelling of the various affected joints," and with little or no fever.

Gout. Acute Gout.

" A specific febrile disorder, characterized by inflammation without suppuration "—in other words, without the formation in the part affected of matter or pus—" but with considerable redness of the affected joints, chiefly of the hands and feet, and especially of the great toe. The disease is attended with excess of uric acid in the blood."

Varieties of Gout.

Chronic Gout.—A disease marked by a persistent gouty condition, with the joints often permanently enlarged from deposit of the urate of soda.

Gouty Synovitis.—Gout attacking the synovial, or lining membrane of the joints.

Chronic Rheumatic Arthritis.—" An affection characterized by pain, stiffness, and deformity of one or more of the joints, associated with deposition of new bone around them." This affection is sometimes confounded with pure chronic gouty disease.

Cancer. Malignant Disease.

"A deposit or growth that tends to spread indefinitely into the surrounding structures, and in the course of the lymphatics in the part of the body affected, and to reproduce itself in remote parts of the body."

Varieties of Cancer.

Schirrus.—Hard cancer. A cancerous swelling, hard at first and then ulcerating. Schirrus often affects the breast in the female.

Medullary.—Soft cancer. A cancerous tumor, frequently of rapid growth. It often becomes fungoid and easily bleeds.

Epithelial. Cancroid.—Surface cancer. A cancer occurring superficially, and ulcerating over a large surface from the point where it commences.

Melanotic Cancer. Melanosis.—Dark cancer. A cancerous growth with deposition in it of black pigment.

Osteoid.—Cancer commencing in bone, and followed, as a rule, by similar development in other organs of the body.

Villous.—Cancer of mucous membrane covered by villi or fine projecting mucous filaments.

Colloid.

"A new growth, a great part of which is formed of transparent gelatinous substance," often attaining a large size. Colloid is doubtfully ranked as malignant.

Tumors. Simple Tumors or Swellings.

The term tumor or simple tumor is applied to a swelling caused by a growth which is not cancerous or malignant. Such growth is sometimes called "benign," or non-malignant.

Varieties of Tumors.

Fibrous tumor.—A circumscribed growth of fibrous tissue, usually firm and of slow development.

Fibro-cellular.—A circumscribed growth of mixed fibrous and cellular tissue.

Fibro-nucleated.—A growth of fibrous tissue containing elongated nuclei.

Fibro-plastic.—A rapidly-growing nucleated cellular growth, the cells being fusiform, spindle shaped.

Myeloid.—A growth of red tint, containing many nucleated cells, and commencing, generally, in the ends of bones.

Fatty.—Sometimes called *Lipoma.*—A growth composed of adipose or fatty tissue.

Osseous.—A growth of bone called sometimes *exostosis*, and presenting several sub-varieties, as *ivory*, or hard and smooth;—*cancellated* or porous; and *diffused* or spreading.

Cartilaginous, sometimes called *Enchondroma.*—A growth affecting cartilage or cartilaginous structure.

Fibro-cartilaginous.—A growth composed of fibrous and cartilaginous elements.

Glandular.—A growth occurring near to a gland and, to some extent, resembling a gland in structure. Sometimes called *Adenocele.*

Vascular.—A growth composed largely of blood-vessels, but increasing slowly.

Nævus.—A vascular growth developing upon or below the skin, and when upon the skin assuming a round or strawberry-like character. Diffused over a considerable surface of the skin, a nævus is called, vulgarly, "port-wine mark" or "mother's mark."

Sebaceous.—A growth containing a fatty suet-like material, and often called a *wen.*

Cholesteatoma.—A growth containing a fatty substance resembling cholesterine.

Molluscum.—A firm dermoid growth connected with the hair follicles and resembling somewhat the bodies of molluscs. The growths attain sometimes a large size and have a pedicle or stalk.

Warts.—The hard, rough, vegetative-like structures occurring on the skin.

Cheloid.—A hard growth on the skin. Is often developed on a cicatrix or healed wound or sore.

Moles.—Irregular raised spots on the skin containing black pigment.

Cysts.

Cysts,—often also called wens,—are hollow growths, more or less firm, containing some substance within them. The contained

substance varies, and so gives rise to modifications of cysts. *Serous* cysts contain watery or serous fluid. *Synovial* cysts, situated near joints, contain synovial fluid. *Bursæ* are the little swellings which occur near to joints, as at the back of the wrist. In addition to these there are also *mucous* cysts; *suppurating* cysts; *sanguineous* cysts,—called by the vulgar blood-warts;—*hemorrhagic; aneurismal; oily; gelatinous; compound* or *proliferous; complex; cretaceous* or *dermoid;* and *dentigerous* cysts.

Lupus. Noli me Tangere.

"A spreading tuberculous inflammation of the skin, usually of the face, tending to destructive ulceration." There are two varieties:—

Chronic lupus; fixed, or not spreading.

Lupus excedens; extending or spreading lupus.

Rodent Ulcer.

A gnawing ulcer, or destructive ulceration going very deeply into the tissues without previous hardness, ulceration, or constitutional affection. The appearance is as if the tissues had been bitten or nibbled out from the surface.

Leprosy.

The Elephantiasis of the Greeks. A disease of the skin, consisting of dark-red swellings or tubercles, with a rough and raised state of the skin generally. The affection is attended with hoarseness of the voice; with a fœtid discharge from the nose; and with ulcerations on the surface of the body.

Scrofula.

A common constitutional disease, showing itself, generally, in symptoms of physical weakness of the body, with external swellings of the glands which often end in suppuration,—formation of matter. In some instances there is a deposit of tuberculous matter in different structures or organs of the body, especially in the lungs and in the mesenteric glands. To this condition or tendency of the body, the term *scrofulous diathesis* has been applied. There are two varieties of scrofula.

Scrofula with tubercle.

Scrofula without tubercle.

There are also several forms of scrofulous affection characterized by their position in relation to the organs of the body that are attacked by the disease. When tubercular deposit, the result of the scrofulous diathesis or constitution, is on the coverings or meninges of the brain, with inflammation, *tubercular meningitis* is said to be present; when on the bag or covering of the heart, *tubercular pericarditis* is the name applied; when the deposit is in the lungs, *consumption*, or *phthisis pulmonalis*, is the disease; when deposit occurs of a miliary or millet-seed character on the surfaces of the body, *acute miliary tuberculosis* is the name adopted; when the deposit is in the mesenteric glands,—the glands of the mesentery, or fold of membrane which connects the small intestine with the posterior wall of the abdomen,—*mesenteric disease*, or *Tabes mesenterica* (*tabes*, wasting), is the name of the disease; when the deposit is on the peritoneum, with inflammation, *tubercular peritonitis* is the local affection.

Rickets.

A disease briefly and sharply defined by the College, as—"A constitutional disease of early childhood, manifested by curvature of the shafts of the long bones and enlargement of their cancellous extremities." The disease arises from a deficiency of earthy matter in the bones.

Cretinism.

A disease equally well epitomized as—"A condition of imperfect development and deformity of the whole body, especially of the head, occurring in the valleys of certain mountainous districts, and attended by feebleness or absence of the mental qualities and special senses, and often accompanied with goître."

There are two varieties of cretinism.

Complete cretinism:—"Characterized by idiocy, deaf dumbness, deficiency of general sensibility, and absence of reproductive power."

Incomplete cretinism:—Or "curable cretinism; a degree of cretinism in which the mental faculties, though limited, are capable of development; the head is well formed and erect; and the special senses, the faculty of speech, and the reproductive powers are present."

DIABETES. DIABETES MELLITUS.

A disease in which there is excessive discharge of fluid from the kidneys, and in which glucose, or grape-sugar, is produced in the body in large quantity, and to which the profuse elimination is due. The urine contains grape-sugar in excess. The exhaustion which follows the loss of fluid is often accompanied by other systemic changes, due to the presence of sugar in the other secretions and in the blood, and to the modifications of nutrition which thereby are effected. Opacity of the crystalline lens,—diabetic cataract,—is, occasionally, one of these modifications of structure; shrinking of the structure of the brain is another; a peculiar type of pneumonia is a third. Diabetes commonly proves fatal. It is primarily due to changes commencing in the nervous system.

Variety.

Diabetes Insipidus:—A form of disease resembling diabetes mellitus in one symptom, viz., the excessive excretion of fluid by the kidney. There is, however, no sugar excreted in this variety of the disease. The affection is more frequent amongst members of the male than of the female sex, and it is less fatal, as it is also less common, than diabetes mellitus. The stage of adolescence, and a few years afterwards, are the periods in which the disease is most apt to occur. The nature, causes, and seats of this malady are indifferently understood.

PURPURA. LAND-SCURVY.

A disease in which the surfaces of the body are affected with small purple spots or blotches of effused blood, but without fever. The blood is exceedingly fluid, with a tendency to the separation of its fibrine. There are two varieties of purpura.

Simple:—In which there is no acute loss or discharge of blood from the body.

Hemorrhagic:—In which the mucous surfaces of the body bleed or give out blood.

SCURVY. SEA-SCURVY.

A disease allied to purpura, but attended with a spongy condition of the jaws and with "livid patches under the skin of considerable extent, which are generally harder to the touch than

the surrounding tissues." The disease is common at sea in those who have been long kept on salted provisions and exposed to much hardship. It has been stigmatized as the "great plague of the sea." It is sometimes called "sea-scurvy," as purpura is called "land-scurvy."

Anæmia.

A disease attended with paleness of the surface of the body and deficiency of the red corpuscles of the blood. A common disease amongst women and amongst the ill-fed and badly nourished of both sexes, in crowded and close localities.

Chlorosis. Green Sickness.

Another form of anæmia peculiar to women and attended with paleness, tending to a green tint, of the surface of the body. The disease occurs after puberty, but rarely after twenty-five or twenty-six years of age.

Beri-beri. Acute Anæmic Dropsy.

A very serious disease peculiar or endemic to Ceylon, part of Madras, the Mauritius, and the coast of Malabar. The disease begins with anæmia or bloodlessness, and terminates in general dropsy. It attacks natives and Europeans, but the latter rarely until after nine or ten months' residence in the affected district. It is often very fatal, destroying one in three or four of those attacked by it. It attacks most severely those who indulge in alcoholic drinks, and men more than women.

SUMMARY.

The reader, if he shall have followed these pages carefully, has now a concise, but fairly complete view of the *general* diseases which in this day afflict humanity in civilized communities. He will, I doubt not, wonder with my friend of whom I have before spoken, that the diseases should be so limited in number, and he will expect to be prepared for entirely new phases of diseased action when he comes to the next part of this work, which treats of local diseases, injuries, and poisonings. In this expectation, however, he will be largely deceived. The list of local affections and injuries will, it is true, be a long one; but it will be found to be made up, in great part, of repetitions of one or other of the

several *conditions of disease*, applied, over and over again, to particular organs and structures; of repetitions or references to certain of the *general diseases* which run a regular course; and of repetitions of some of the diseases which have been classified as of *constitutional* type. In a word, essential as it is to become acquainted with the local diseases and injuries, the reader will find the fact remaining that, if by preventive art we could control the comparatively small number of conditions and affections which have been detailed in the last three chapters, we could control the local diseases as well as the general, and could prevent the whole, with the exception, always, of that final process of decay which forms the prelude to natural death from ripe old age.

BOOK I.

PART THE SECOND.

LOCAL DISEASES.

CHAPTER I.

THE SEATS OF LOCAL DISEASES. A PHYSIOLOGICAL OUTLINE.

In the preceding four chapters we have studied the subject of human diseases as divided into those which are general and those which are local, and in the last two of these chapters we have taken a brief analytical review of the general diseases as a whole. To take into similar review the local diseases is our next task. For the purpose of this book it will be convenient to depart a little from the plan of the Royal College of Physicians in specifying the local affections, in order to condense the narrative and bring the facts of it into close compass. With this intent I shall place the local diseases under nine heads, corresponding to the systems of organs of the body;—the digestive, circulatory, respiratory, nervous, sensory, glandular and absorbent, muscular, osseous, and membranous.

Let me, however, in a brief preliminary manner, first describe these systems.

If we could by some sleight of science look physically through a living man and see how all his vital organs work, as we can look into the mechanism of a watch or a timepiece, we should discover in the nine grand systems of working organs, some active in their uses, some passive, but all playing important parts in the duties of maintaining or utilizing life. We should also discover them to be all bound together for a common object, that of bringing the various organs and systems of organs into one organic frame or whole; so that while each system and each organ is to some extent independent of the others, such intimate ties hold them all together, that it is difficult, if not impossible, for one alone to suffer and for the rest to be unaffected.

The Digestive System.

In the trunk of the body, we should first observe a tube which the ancients very correctly called the *primæ viæ*, the first ways, and which we moderns call the digestive, or alimentary tube. The tube is truly the first way. It is the canal which receives the aliment out of which itself and the whole of the body is built up. It is the centre from which the body that is to be proceeds, in crude form it is true, but prepared for elaboration. Into this long canal, which, laid out and measured, would, in the adult, be found to be not less than thirty-two feet in length, and which is composed of many divisions, each playing, as we shall see, its own part in digestive work, the food and drink enter. Received here, the drink, if it be soluble, if it be water or a fluid miscible with water, is at once taken up by membranous and vascular absorption into the blood. The food, solid or semi-solid as it enters the mouth, is ground there or masticated, mixed with saliva which helps to fluidify its starchy and fatty parts, and is then swallowed into the stomach. In the stomach this food is digested and churned until its albuminous or flesh-forming structures are brought into solution, and this effected, the prepared fluid is passed into the first part of the intestine below the stomach, the duodenum, where, meeting with the secretions from the liver and pancreas,—the bile and pancreatic juice,—the starchy and fatty, or heat-producing, portions of it are emulsified, liquefied, and made ready also to be absorbed and further utilized. Thence the prepared nutriment, passing into a longer line of intestinal canal, the jejunum, and ileum, is further digested, and at last is, directly or indirectly, conveyed by two classes of vessels into the circulating blood, and through the blood into all other structures, to become for a time the veritable body of the man,—bone, muscle, sinew, nerve, eye, ear, heart, vessel, membrane,—everything there is of body.

Finally, from that long absorbing portion of the alimentary tube sundry parts of the food that have been taken and are not wanted are passed into the large intestines,—the cæcum, colon, and rectum,—with gases generated in the process of digestion, and *débris* of food that could not be digested or applied to the purposes of life. These are all passed on into the larger recepta-

cle of the intestine to be expelled, as the ejected results of the digestive process.

In observing the parts of the digestive system we should note various structures and organs, beginning at the lips and extending to the lowest part of the intestinal tube. The canal is lined with the red mucous membrane which we see at the lips, and which, throughout its entire length, is surrounded by two layers of muscular fibres, one longitudinal or long, the other circular. These are all enclosed, in some parts, in a strong investing sheath, the stomach and intestines being further invested, in great part, with a delicate serous membrane called the *peritoneum*.

The parts of the alimentary system to be observed would be:—(*a*) the *mouth*,—into which the saliva is poured,—the *tongue*, the *fauces* or back of the throat, the *palate*, the *uvula* and *tonsils*. (*b*) The *pharynx*, or dilated pouch at the back of the throat, ending in (*c*) the *œsophagus* or gullet,—the tube extending from the pharynx to the stomach. (*d*) The *stomach*, or first true digesting receptacle, in which the albuminous or flesh-forming foods are transformed during primary digestion into chyme, which is passed through the *pylorus*, or exit gate of the stomach, into the duodenum. (*e*) The *duodenum*, or first portion of the small intestine, into which the liver pours its bile and the pancreas its emulsifying juice, and in which the fatty and starchy portions of the food are digested,—secondary digestion,—before being carried into the next small intestines. (*f*) The small intestines, *jejunum* and *ileum*, in which digestion is completed, and from which the prepared food is absorbed into the blood, partly by the veins,—direct absorption,—and partly by the villi or absorbents which line the intestinal surface, and which convey the fluid to the glands of the mesentery, from whence, after elaboration, it may pass into the *thoracic duct*, and by that channel find its way into the veins, and so into the circulating blood. (*g*) The large intestine, called the *colon*, for receiving the *débris*, the undigested or useless part of food substances, and the gases arising from digestion. The colon springing from a pouch, the *cæcum*, situated at the end of the small intestine on the right side, first ascends, and then extending across the abdominal cavity from right to left, next descends, and at last terminates on the left side in the straight intestine. (*h*) The straight intestine, *the rectum*, with the outlet of which the canal is terminated. (*i*) The peritoneum

or serous membrane of the abdominal cavity, in which the stomach, the intestines, and other abdominal organs are in great part infolded, and which lines also the walls of the abdominal cavity.

Within the canal on the mucous surface at various points we should discover glands or secreting organs. Gastric glands in the stomach, for secreting the gastric juice; two large external glands, the liver and the pancreas, pouring bile from the liver and pancreatic juice from the pancreas, into the first part of the small intestine, or duodenum; and other smaller glands along the mucous surface of the small intestines.

Shall any local disease, functional or structural, visit this system of organs, indications of general and local disorder must needs ensue. The old fable of the belly and the members is retold. Let the alimentary canal fail in any of its duties; let its salivary juices be inactive; let its stomachic digestive juices be deficient or inactive; let its intestinal juices be deficient or inactive; and the balance of supply to the organism will be disturbed. Or let the tube be obstructed, so that food cannot enter the digestive apparatus freely; or, entering and being digested, cannot pass on for absorption; or, passing the absorbing surface, cannot discharge itself; then, the balance of supply to all parts must be disturbed. Or let the mechanical part of the digestive system fail; let the mastication be imperfect; let the swallowing be difficult; let the churning movements of the stomach be enfeebled; let the transmitting power or motion of the lower parts of the canal be irregular; then the balance of supply of food to all parts must be disturbed. Once more. Let the absorbing portion of this system be in any way impeded, and the balance of supply in all parts must be disturbed. Lastly, let the digestive system, perfect in itself, be overloaded or overcharged, or undercharged, or improperly charged with foods and drinks, and the balance of supply to all parts must be disturbed.

If to these facts we attach one more, namely, that by nervous communication the intestinal canal is brought into communion with all the nervous centres in which vital acts, automatic and voluntary, have their seat, we discover how the digestive system, as a system exposed to local diseases, holds a first place for our consideration. It has been called the *primæ viæ*, the first ways; it might with almost equal truth be called the first ways of dis-

ease. Indeed the most learned have not as yet discovered how many diseases take their origin there.

The Circulatory System.

Keeping our minds still intent on studying the construction of the body during life,—looking through the man,—we should observe that the fluids prepared by the process of digestion find their entrance into another tubular system by which they are carried round the body in two circuits, one large, including all the body, the other small, and including only a part. We should see that the fluid which leaves the alimentary organs, white or milky in color, is, in this next system of tubes, of red, or bluish red, color, and that it has become a red, tenacious, and coagulable or clotting fluid which flows from a wound in the body directly a wound is made, and which is called blood. The new supply of this blood, received from the digestive parts, would be seen borne along by a series of tubes of a darkish blue color, which, from all parts, head, limbs, trunk, are making for one point, like a river which, springing from several sources, is making for a lake into which it will finally discharge itself. These tubes, as an anatomist would explain them to us, are called *veins;* and the point they are making for, in order to give up their currents, is the pulsating organ on the left side of the body, lying in the cavity of the chest above the stomach, and separated from the cavity holding the stomach by a partly fleshy, partly tendinous partition, the diaphragm or midriff. The beating or pulsating organ disclosed to us we should be told to recognize as the *heart.* The heart, we should discover, to be formed of four hollow structures, each structure expanding and contracting in perfect rhythmical order. The veins carrying their blood would be observed to pour the blood into the upper small dark cavity on the right side, called the right auricle of the heart. There, being compressed by the contraction of that cavity, the blood would be seen to be driven into a cavity immediately below it, through a valve, the tricuspid, which placed in the intervening opening would allow it to pass downwards, but would not let it pass back again. Here arrived we should see this lower cavity, called the right ventricle, contract; the valve, consisting of three segments, rise and close up with a dull sound, so as to let no blood get back into the auricle from whence it came; and the blood itself make its way to

a large vessel springing out of the lower cavity and then move towards two spongy-looking organs, lying above the heart, named the *lungs*. As it passed into this vessel the blood would be seen to push up before it three little flaps of valves, shaped like crescents,—the semilunar valves,—and as it filled the vessel the vessel would expand for a moment, and afterwards contract, like an india-rubber tube expanding and contracting from fluid pumped through it. The contraction of the vessel on its contained blood would drive down, with a sharp click, the three little crescent-shaped or semilunar valves; and as by their closure the blood would be prevented getting back into the heart, it would be driven up into the two spongy lungs above. It would enter the lungs dark in color, but, as they moved in breathing, as they expanded, the color of the blood would be found to change, and to become of very bright red. Thus changed the blood would be detected leaving the lungs, and by four small vessels going back again to the heart. The four vessels would be found directing their course to another small cavity of the heart at the top of the organ, a cavity lying on the left side, on a level with that cavity on the right side which took in the blood from the veins, and which we understood was the right auricle. This second small cavity, also called an auricle,—the left auricle,—would be seen to be the receptacle of the blood from the lungs. It would be discovered filling with red blood from the lungs as its fellow filled with dark blood from the body. It would contract after it had filled, in the same way as its fellow, and at the same moment, but in contracting it would drive its charge into another cavity of the heart lying beneath it, called the left ventricle. The blood, passing through the opening from the left auricle to the left ventricle, would force open a valve,—the mitral,—composed of two curtains which would let it enter and fill the left ventricle. Next, the ventricle would be seen to contract, the curtains of its valves to rise, then close with a dull sound, and the blood, unable to go back into the auricle, would be observed to ascend towards another large tube, which, springing from the ventricle, makes a beautiful arch that stretches three to four inches over the heart from right to left. The blood moved, by the contraction beneath, towards this vessel, called technically the great aorta or great arterial vessel, would be discovered, as before, to lift up three little crescent-shaped valves,—aortic semilunar valves,—as it passed into the

vessel. Under the pressure we should now behold the big elastic aortic vessel expand, so that its whole bow or arch is included in the expansion. In an instant its expansion would, however, be followed by its contraction, the little crescent valves would go down with a short sharp click or sound, and the column of blood, unable to get past the little valves back into the heart, would be carried in the direction of the aorta into the vessels that branch off from the aorta, in its course over the whole of the vascular system.

And now, if we continued to follow that column of blood thus ejected from the beating heart through the great arterial vessel, we should have to look for it at every portion of the body from head to foot; for wherever there is a living part of the body the arterial blood will permeate. The great vessel dividing into smaller vessels, penetrates, it will be noted, every limb and every organ, not excepting the hard skeleton itself. The vessels beat with the heart and give us the pulses we feel in the wrist, the temple, and other portions of the body. The small vessels subdivide into smaller still, and by continuance of subdivision the whole system of vessels passes into one vast hair-like,—capillary,—web of tubes expanding out in all structures, looking like the ultimate branches and foliage of a tree, and forming, in fact, the whole organic outline of the corporeal frame.

I have elsewhere called this fine net-work of ultimate vessels the minute circulation. It is in fact the organism, as we look at it, spread out in proper form. We see in it the features and outlines of every structure and organ. It is, as it were, the living canvas on which the organism is constructed. Here the blood yields up its constituent portions to make organs, bone stuff for bone, muscle for muscle, nerve for nerve. Here the animal fire glows, the blood from the lungs breathing into it its vital air. We may, as we look at it, almost see it as a slow but steady animal fire.

At the same time we are led to observe that the blood, carried into this vital arena, does not rest there. We detect that by an infinite number of minute vessels, springing from the vital arena, it returns back, after making its extended circuit, to the heart. It returns now dark in color. It collects in small veins. The veins by tributaries become larger and larger, and so the whole volume of blood, from the great minute circulation, goes back again

through the venous trunks to the right side of the heart from whence we behold it start, to repeat its round on its greater and lesser circulations.

In the construction of this vital system of organs,—as will already be gathered from the above,—is included the blood itself; the heart or propelling organ; the arteries; the minute circulation; and the veins. The *blood*, arterial and red on the one side of the system, venous and dark on the other, is a fluid having a specific weight of 1055, compared with water as 1000. It has an alkaline reaction. In the body it flows along the vessels in a thin liquid state, although a part of it is in the solid form. It consists of corpuscles or globules, which float in a saline albuminous fluid, and which are so small that they pass through the minutest vessels. The globules are of two kinds, red and white. The red globules, each about the three-thousandth of an inch in diameter and the ten-thousandth in thickness, are four-hundred times more abundant than the white. In the lungs they receive oxygen from the air, carbonic acid being given off as oxygen is taken in. In the extremities of the circulation they give up oxygen, and, as I have elsewhere shown, assist in condensing the carbonic acid formed during the animal combustion. The fluid in which the corpuscles float,—liquor sanguinis,—is composed of water, albumen, fibrine, and saline matter. The proportion of the parts of the blood in the thousand is:—water, seven hundred and eighty-four parts; blood corpuscles, one hundred and thirty; albumen, seventy; fibrine, two and a half; fatty substances, one and a half; chloride of sodium,—common salt,—three; other inorganic salts, two; extracts of grape sugar, coloring substances, and organic salts, six. Iron is one of the inorganic constituents of the blood; it exists in the red blood corpuscles.

While the blood is circulating in the body the whole mass seems fluid, the red corpuscles being afloat in the stream, and so mobile as to convey the idea even of their fluidity. But when blood is drawn the fibrine separates and coagulates, or sets, enclosing the blood corpuscles in its setting, and forming that red blood clot by which wounded vessels are plugged up and closed. The arterial, red, or out-going blood contains the oxygen; the venous, dark, or returning blood contains the carbonic acid. The temperature of the blood is 99° Fahrenheit. The arterial blood goes forth in jets from the heart; the blood in the minute vessels flows

as through a sponge; the venous blood flows in steady circuit towards the heart.

The *heart*, the central driving organ of the circulation, we should find to be,—if we carried our inquiry so far,—made up of muscular fibres, in fact, a strong muscular organ. We should discover that it possesses an independent arterial and venous circulation of blood, and that it is fed by the first supply of blood which it, itself, pours forth. We should learn that it has two lines of nervous supply, one stimulating it to motion, the other controlling its motion. On its outside, the heart would be disclosed as coated with a strong fibrous membrane which can be stripped off its surface, and this membrane, reflected on and over the heart, would be observed as enclosing the organ in a membranous bag,—the *pericardium*,—containing a small quantity of serous or pericardial fluid. Inside the muscular organ we should find another fine strong serous membrane lining the walls and the four sets of valves of both cavities of the heart,—the *endocardium.*

The *arteries*, if we looked into their structure, would exhibit a smooth internal lining or coat,—epithelial,—surrounded by a coat of elastic fibres. Next to the elastic fibres would be detected a middle coat of circular muscular fibres with some interwoven elastic tissue; and outside all a firm strong coat, made up of connective tissue containing some more elastic fibres. Thus an artery is elastic under internal pressure or dilatation; contractile by its own muscular power; and strong and resistant by its external investment.

If, following up the arteries, we paused to consider next the *minute circulating or capillary system*, we should come upon a simpler but much more extended vascular arrangement. We should find a web or net-work of vessels, springing from divisions of the arteries, and themselves now of nearly equal dimensions, one-three-thousandth of an inch, throughout. A lining and surrounding membrane is all that would be found in the finer structure of these vessels; but there would be exposed a free supply of nerves, under the influence of which the small vessels would either contract or dilate, as directed by the nervous current. The contents would still be the blood, the corpuscles of which would be seen to pass in single file, through the capillaries. The inner lining of the capillaries, derived or continuous from the arteries, would be traceable into the veins.

The *veins* rising, as it would appear, from the capillaries and passing on towards the heart, increasing in size as they progress, would be disclosed to us next as a series of tubes closely resembling the arteries but less strong in structure. Internally we should detect in them a similar epithelial coat or lining; around that a lining or coat of circular muscular fibres with some elastic fibres; and outside all a covering or coat of connective tissue. In addition, the veins would present interiorly a series of small valves, derived from their inner coat, which open upwards and direct the blood onwards in its course to the heart.

Shall any local disease visit this circulating system the result must be some disturbance of the balance of life. Let the blood be changed in physical property; let the heart overact or fail in its beat; let the valves of the heart get wrong; let the arteries or veins give way; let the vital arena of the minute circulation be the seat of change, let its minute vessels distend or break, its fire glow too fiercely, or its fire die out in whole or in part; and the result must be disturbance of the balance of life.

The Respiratory System.

From the circulation and the parts of which it is, as a system, composed, we would next, naturally, turn to the respiratory system at which we did already briefly glance when our attention was directed to the course of the blood from the right to the left side of the heart. In the respiratory mechanism we should observe the mode in which the blood is changed from the dark venous to the red or arterial hue. We should see in the two spongy organs, the *lungs*, one on the right, the other on the left side of the chest, the vessel which comes into them from the right ventricle of the heart dividing into two large branches, a branch for each lung. We should observe, further, that the vessel belonging to each lung divides again into smaller branches, and that these smaller branches, after numerous divisions and subdivisions, become, at length, a vast web of very fine vessels, like to the minute circulation of the body at large. We should, in this instance, however, detect a difference, owing to the introduction of a new element into the refined circulation of the lung. We should discover that in the net-work of the minute vessels of the lung as the vessels pass on in their course to form the commencement of veins, there are interposed mill-

ions of little vesicles or bladders, over the outer surfaces of which the web of vessels spreads. We should find that with each breath drawn the little vesicles expand, while with each expiration of breath they contract, so that the whole mass of the lung expands and contracts by the expansion and contraction of the whole mass of the vesicles. Tracing out the meaning of this we should learn that the tiny vesicles are the terminal pouches or cysts of small tubes from which they cluster, something like as grapes cluster from their stems. Following the tubes from the vesicles we should trace them becoming larger and firmer, until at last they became large strong tubes lined with mucous membrane, coated with mucous secretion, and filled with air. Finally we should see that the tubes, as they increase, become firmer still,—constructed now of rings of cartilage,—and that at last they emerge, by a single tube, from the right lung and the left, to form one common large tube which runs up to the throat, and opens into the throat by a chink from which the sound issues when the voice is heard. The anatomist would tell us that the tubes springing from the little vesicles are the minute ramifications of what he calls the bronchial tubes; that the larger tubes are the bronchial tubes themselves; and that the final large tube, ending in the larynx or voice-box, is the trachea or windpipe. The anatomist would also explain to us that all the parts named as belonging to the lungs, the large blood-vessels, the minute blood-vessels, the air vesicles, the bronchial ramifications, and the bronchial tubes, are united together, in each lung, by connective tissue and by abundance of elastic tissue; and that each lung, made up of a great number of little lobules, all constructed on the one plan, is finally included in a delicate, semi-transparent sensitive membrane. This membrane surrounding the whole spongy mass, is reflected over the walls of the chest, enclosing the lung in a double bag,—the *pleural membrane*, or *pleura*,—the bag or space of which is the *pleural cavity*.

If, now, knowing these general facts of construction, we looked at the intention of so much fine and beautiful mechanism, we should detect that in each act of breathing the chest, by its expansion, draws, like a bellows that is being expanded, a quantity of air, from three to four cubic inches by volume, into the lungs through the windpipe; that under this the small air vesicles are filled with air; that during the expansion of the vesicles the

blood, which courses over them in the minute circulation of the lung, changes in color from dark to red. We should further detect that, in expiration, or emptying of the chest, the vesicles contract, and give back into the bronchial tubes and into the windpipe, and so into the outer air, the same or nearly the same quantity of air as that which they took in during inspiration.

One change more would demand our attention. The air which the tiny vesicles receive in the act of drawing in the breath is common atmospheric air. It is a mixture of two gases in unequal quantities. Nearly four parts out of five are made up of a gas called nitrogen; rather more than one part is made up of a gas called oxygen, in which gas substances capable of going into flame or of being more slowly consumed by slow combustion, burn, with evolution of heat. From this atmospheric air then we should see, as it passes over into the air vesicles, a certain portion of oxygen extracted by the blood. The myriads of small disks of red color floating in the blood stream would be observed to seize upon the oxygen till saturated with it, while the blood would give up, in return, into the bronchial tubes, the windpipe, the mouth and nostrils, and the outer air another gas, a mixture of oxygen and carbon,—carbonic acid,—with some returned nitrogen, and with some unused oxygen.

Presuming that we were not acquainted with the nature of this curious process, we might think that by these interchanges of air and blood some heat was produced in the lung when the dark blood began to glow. The industrious scholars who first noticed these changes thought so, naturally enough. We know better now. The process is all for this primary end, that the blood may be charged with oxygen and may carry oxygen into that minute circulation of the body at large which we have already seen to be the vital arena. There the oxygen is to be given up; there the animal fire is to burn; there the carbon supplied by the food is to consume; and there the blood, losing its oxygen, is to exchange it for the newly-formed carbonic acid, and to convey that product of combustion to the lungs, to be cast off by them.

To render the physical mechanism of the lungs more perfect, there is planted,—as the microscope would next reveal to us,—all along the mucous membrane covering the bronchial surface, not only bronchial glands to afford secretion, but an exquisite apparatus called the *ciliary*. This, if we got to view it, would be

found to consist of an immense number of fine processes,—*cilia*,—which pave the mucous membrane round the tubes and keep ever in motion, like the waving motion of corn in the breeze, towards the outlets of the tubes. Thus fine particles of offending dust drawn into the depths of the lungs, in inspiration, are wafted back by the cilia, and brought into the throat by the windpipe, are removed from the lungs by being expectorated or swallowed.

Shall any local disease visit this respiratory system, the result must be some disturbance of the body at large. Let the bronchial channels be obstructed, then the animal fire, unfed by vital air, must decline in proportion to the obstruction, even to the extent of going out altogether. Let the air contain some gas or vapor that modifies the character of the respiratory act or carries new matter into the blood, and the whole body must suffer. Let the minute air vesicles be charged with fluid, or be congested with blood, or be dilated, or broken, and the whole body must feel the disturbance. Let the structure of the lungs be the seat of a new growth, and the whole body must suffer something from the mischief. Let the heart fail to send arterialized blood to the minute circulation, or blood that cannot sustain combustion, and the whole body must needs collapse. Let the sensitive pleural membrane be injected with blood, or rendered dry and inflamed so that its surfaces rub one against the other, and pain will follow, from the lowering effects of which all the body will sympathize. Let the surfaces of the pleural membrane be fixed by adhering one to the other, or be compressed by an excess of fluid secreted between them, and so much breathing power must be lost, to the comparative detriment of all the organism. Lastly, let the elasticity of the elastic fibre of the lung tissue become impaired, and the vital capacity, as a whole, must suffer relative impairment.

The Nervous Systems.

Keeping our attention still directed on the construction of the living man, looking through him still, we should remark that in parts of his organism, on the terminals of his vascular system, there are certain solid organs from which spring an infinite number of cords and threads, to traverse the body in as many directions as the blood-vessels themselves, and to enter freely into the fleshy structures, to which, at times, they seem to impart motion. At the uppermost part of the body, crowning the whole, and

occupying the cavity which we call the skull, the largest of these organs,—*the brain*,—will lie before us. It fills the cavity of the skull. It is divided into two parts, one part large in front and above, the other small and concealed behind the larger, and both divided by a vertical or perpendicular separation into two sections or halves. From the back of these structures we should also see a cord of the same kind of substance extending along the central opening in the long column of bone known as the spinal column, —*the spinal cord.* From these great centres in the cavity of the skull and in the cavity of the spine, we should next see a series of small white cords, proceeding to their various destinations. The anatomist would tell us that the large mass in the fore part of the skull is known as the *cerebrum*, or larger brain, and that each half of it is called a hemisphere; that the smaller lower mass,—seven times smaller than the larger,—is known as the *cerebellum*, or smaller brain, the two halves into which it is also divided being its hemispheres; and that the long cord passing along the spinal canal is the *spinal cord*, the first part, a little more than an inch, proceeding from the two brains,—for he would show us that it does proceed from both,—being particularly defined as the *medulla oblongata.* The smaller cords that come off from the brain and from the spinal cord he would designate as *nerves.* He would explain to us that all these parts, large brain, small brain, spinal cord, and nerves, form one great system, of which he would speak as the *cerebro-spinal system;* and he would demonstrate that the centres of this system are not merely covered by bone, but by membranes also, three in number. Upon the actual surface of the brain and spinal cord he would show a fine web of blood-vessels, a nutrient membrane, the *pia mater* (good mother); above that, and coequal with it, a delicate serous membrane, so delicate that he calls it the *arachnoid*, spider-web-like membrane, yet active enough to secrete a layer of fluid to interpose between the brain and the firm over surrounding parts; while enveloping the whole, he would exhibit to us a strong, hard, fibrous, white membrane, inelastic and smooth, lying between the delicate arachnoid and the inside of the bony cavity, which firm membrane he would call the *dura mater* (hard mother). Turning then to the brain and spinal cord enveloped in the three membranes,—pia mater, arachnoid, and dura mater,—he would describe to us that they are each made up of two kinds of nervous matter, one dis-

tinctly white, the other as distinctly gray. In the brain he would bid us observe that the gray matter is all on the outside and gathered up into folds, or convolutions, the white matter being enclosed within it; while in the spinal cord the gray is in the centre and the white on the outside. He would show, too, that the gray matter, very rich in blood supply, is composed of an infinite number of minute cells, held together by a soft nervous connective substance, nerve cement; and that the white matter, more clearly linear, and made up of fibres similarly connected, is the apparent origin of the nerves which are passing from the centres to deploy over the body at large. In relation to the nerves he would indicate that some go from the brain to special structures, the eye, the nose, the ear,—nerves of special sense; and that the nerves which issue from the spinal cord pass off from it in pairs on each side the cord. He would trace out thirty-one pairs of spinal nerves, each nerve having two origins or roots, one from a back segment, the other from a front segment of the cord, which is in fact built up of four columns, two on each side, as if for this special purpose of dividing the nerves into pairs on each side.

Of the nerves themselves he would give us a ready demonstration. He would show us that the nerves going from the brain to the organs of the senses spread out, at their terminations, into a sheet or screen, endowed with active cells like a small spread-out brain, at the far end of the connecting nerve. He would show that the nerves which go off from the spinal cord, divided into two roots at their start, soon unite into common or compound nerves, and that these combined nerves, with others from the brain not destined to go to the organs of the senses, are distributed either to the fleshy parts or muscles, or to membranes and skin. Here, in their infinitely fine terminations, they would be found making a surface or net-work equivalent to the vascular net-work we have already surveyed, and probably equivalent in material quantity to the nervous centres from which they spring.

And now if, turning to the meaning of this elaborate construction, we could mentally realize what was effected by it, the lesson would indeed be curious. We should see that whenever an external vibrating impression,—a picture to the eye, a sound to the ear, a friction on the skin,—is made on a part of the great terminal nervous surface, the vibration is conveyed directly away to the communicating centre, telling it, as it were, what has

occurred. Or we should see some indication of will made in a centre, and conveyed from thence to the nervous termination, bidding that to set in motion muscular fibre, and creating, for a time, motion of body or limb. We should notice that all kinds of motor connections from the centre pass through the front columns of the spinal cord; while all counter impressions, from the extremities of the nerves to the commanding centres, pass through the columns that are at the back of the spinal cord. Thus in the cerebro-spinal system we should witness the connections between will and actions of will; the mode by which the physical impressions of the outer world are poured into the inner man to inspire him, while he lives, with the life of the outer world; and the mode by which he responds to, or reflects back, those inspirations.

But another survey of the nervous microcosm would be necessary. The cerebro-spinal is one nervous system. There is a second. Our anatomist, ready to instruct us here also, would disclose for us the centres of this second nervous system, not in the bony cavities of the skull and spinal column, but in the trunk of the body itself, in the great cavities where lie the lungs, heart, stomach, and intestinal canal. Behind these organs and running in front of the spinal column, on both sides of it, he would point out a double line of small masses of nervous matter,—*ganglia*. These, he would indicate, extend, on each side, through the neck, up to a point inside the skull a little above the eyeball. Of these masses, the largest not much larger than an almond, he would count for us twenty-eight in each chain. He would demonstrate, springing from these centres, sets of nerves which pass off from each centre in four directions, and often closely communicate in their course with the nerves of the cerebro-spinal system. He would tell us, that in addition to this chain of ganglia there are other distinctive ganglia and plexuses of sympathetic nerves connected with the heart and all the vital organs; and one great ganglion, *the semilunar*, near to the stomach, which receives branches from the cerebro-spinal system, and which sends off radiating fibres to so many organs,—stomach, diaphragm, liver, kidneys, and intestines,—that it was called, by the oldest physicians, the great solar or radiating plexus.

But chiefly would the anatomist interest us by pointing out the leading course of the sympathetic nerves from their chain of ganglionic centres, in the direction of the lines of the arterial

blood-vessels. He would expound forcibly and do all in his power to fix on our memories the fact that wherever arterial blood-vessels are distributed, whether they go to muscles, or glands, or nervous masses, or membranes, or skin, or to their finest terminations in the vital arena, they are attended, to their ultimate branches, by a fibre from this system of organic nerves.

We look, naturally enough, as we witness this demonstration, for an explanation of its meaning. We gather on inquiry that if we could see the mechanism, it is this. The nervous masses of the chain are the centres of what is known as the sympathetic, organic, vegetative, or ganglionic system, and they are called, as we know, ganglia. In them, from the blood which supplies them, nervous force or stimulus is always being produced. From them the nervous influence is at all times passing, independently of will, automatically that is to say, through the nervous cords to the arterial tubes and to their terminals. Over these fine blood-vessels, at their extremities, the nervous influence so supplied exerts a perfect control as long as the action is steadily maintained, and by that control the vessels of the minute circulation are regulated. Each vessel, fine as it is, being thus obedient to nervous direction, is so governed that, under the stroke of the heart, it shall admit the right quantity of blood, and distribute the proper supply to the vital arena with as much order and rhythm as the pulsating heart shall deliver the supply.

These are some of the phenomena derivable from our survey of the nervous systems. The knowledge is a treasury as applied to the diseases of human-kind. Shall the great centres of the cerebro-spinal system be injured, how can they receive external impressions, how can they deliver commands in response, or reflect back what they have received, in due time and order? Shall the nerves conveying sensible impressions to a part be interrupted in their work, then the part, cut off from its nervous centre, must be rendered senseless. Shall the nerves conveying motion from a centre to a part be interrupted in their function, the part must be rendered motionless,—paralyzed. Shall a portion of nerve in the nervous circuit be excited, or irritated, the irritation, reflected by intercommunicating fibres to many centres, may produce various movements or sensations which may be quite remote from the original direction, as well as in it. Shall the expanse of an organ of sense be over-excited, the effect may tell, perchance, on all

centres. Shall an interruption occur between an organ of sense and its centre, the sense will fail in proportion to the interruption. Shall the centres, the masses of gray matter of brain and spinal cord cease to act; shall the active cells which move in the connecting substance or nerve cement die out; or, shall their surrounding substance become, as it is apt to become, too solid and firm; then all parts supplied from cerebro-spinal tracts thus injured will, virtually, live a vegetative life, receive no impression, deliver no impulse nor command.

The most striking piece of learning of all, would, however, be gleaned from the study of the automatic nervous regulating process carried out by the second nervous system, the organic, sympathetic, vegetative, or ganglionic nervous chain, the nerves of which follow the arteries throughout their course. Shall this nervous system be subject to disease, functional or actual, then instantly the tale is told. By a sudden blow or mental impulse of surprise or emotion the centres of this system being for a moment overpowered, the blush of red blood on the cheeks and over the surface of the body will declare that the control over vessels has been checked as far as the termination of the nervous fibre; while the glands that may be involved in the same shock, and for the same reason left uncontrolled, will weep and pour out their secretions in copious streams. Shall the shock be so extreme as to communicate a vibration from the centres, the nervous fibres will be irritated so decisively as to close the arterial terminals and shut off the blood stream in the vital arena. Then sudden and death-like pallor will seize the surface of the body; the brain-cells, unsupplied, will fail to yield consciousness; a load of blood cast on the struggling heart, itself the first organ to be robbed, by the shock, of its arterial supply, the heart will sink in its beat, and all the powers prostrate, there will be primary death, syncope or faint, an apparent prelude to that which shall close all access to impression and all impulse of will, death.

Again, shall these organic nervous centres be injured in parts so that local supply from them is impeded, then the structures they quicken will suffer in proportion to the injury. The vessels will be congested of blood or surrounded by effused fluid derived from blood which may undergo a false organization, and all the natural functions become deranged.

Lastly, if the extremities of the nerves of this organic system

be affected, as they are constantly, by various changes, of heat, or cold, or mechanical motions acting upon them, thereby interrupting the current supplied to them from their centres, the effect on their function is instantaneous. The part or organ to which they minister is made red, or pale, is heated or cooled, as if by the mere motion of the agent itself that exerted the change. Thus the skin held before the fire glows; the skin held in the cold grows white; the skin recovering from exposure to cold grows red and feels hot; the hand covered with turpentine or mustard reddens and burns; the eye irritated, the lachrymal gland weeps; the membrane of the nostrils excited, is first made dry and then pours forth a secretion,—catarrh; the lungs taking in first a warm and then suddenly a cold air, become congested with blood; the lungs inhaling a gas which excites them, the whole body is rendered red or pale, is convulsed or collapsed. In each and all of these disturbances it is the organic nervous chain or its fibres that have experienced the shock or communicated the results.

The Sensory System.

While yet our minds were occupied with the task of observing the construction of the nervous organization we should see connected with certain parts of it a special adaptation for bringing it into communication with the motions of the external world. We should discover in connection with it two organs of purely optical character, for condensing and focussing light, for receiving a picture on a nervous screen, and for letting that picture pass to the brain. These are the organs of sight. We should see two other organs for collecting the atmospheric waves which cause sound, for receiving the impressions so collected on a nervous expanse, and for transmitting the impressions to the brain. These are the organs of hearing. We should discover, in a third part, a nervous surface supplied with a much simpler plan of condensation, for receiving the impulses, in this case perhaps purely mechanical, which odorous particles impart to the nervous sense. This is the organ of smell. We should discover in another portion, at the tips of the fingers, a small nervous body containing a little gray matter and surmounting a filament of a nerve for receiving the special impressions conveyed by delicate pressure on an external object. This is the organ of touch. Lastly, in a less perfected and certain form, we should discover a nervous expanse in a por-

tion of the tongue and palate, for the reception of impressions conveyed by foods, drinks, and other substances which may enter the mouth. This is the organ of taste.

Our anatomist would describe to us in respect to these organs that in every instance the design is carried out on the same principle, though the details vary considerably in each case. He would show to us that there is, in all instances: (*a*) a collecting part of the organs for bringing together the vibrations that have to be absorbed; (*b*) a receiving nervous surface for taking up the impression; (*c*) a special nerve, originating in the nervous receiving surface and going to the brain, for conveying the impression; (*d*) a receiving part within the brain itself, by which the impression is finally brought into the physical domain of thought and consciousness.

Defining these general facts by and from the special organs, the anatomist would show to us that in the organ of vision the condensing part consists of three duly adjusted lenses: of the *cornea*, or concavo-convex lens in front of the eye, fixed into the hard sclerotic white coat which forms the outer part of the ball of the eye; of double convex lens situated further back within the globe of the eye, and called the *crystalline lens;* and of a third fluid transparent structure, concave in front, convex behind, made up of many segments in membranous divisions, and filling the greater part of the globe, the *vitreous humor* or lens. He would show also that between the first and second of these lenses there is a perforated curtain which, responsive to the stimulus of light, closes or opens automatically, so as to exclude light or admit it freely according to circumstance, *the iris.* He would explain that the inner surface of the globe of the eye behind the curtain is clothed with an absorbing dark coat, the *choroid;* and that on the choroid is spread the nervous expanse, the *retina*, for receiving the picture or impression of the objects which gave or reflected the waves of light. He would show us the nerve, the *optic nerve*, which proceeds from the retina of each eye to the brain; he would trace that nerve in its course, and point out how on each side at a certain point within the skull it meets and conjoins with its fellow from the opposite side, and then passes on in separate or amalgamated tracts to the brain to be lost in the matter of the cerebrum. Lastly he would describe how the eye is moved in the orbit by six muscles, and how it is lubricated by a fluid, secreted

from a gland lying above it in the outer corner of each eye, the *lachrymal gland*, the fluid from which, after it has flowed over the eyeball, escapes by a minute opening, the *lachrymal duct*, and, finding a ready passage into the nasal cavity, on each side, is disposed of there by evaporation.

From the eye, as the organ of sight, our guide would lead us to the organ of hearing, the ear. He would show us a tube on each side of the skull, for the collection of sound, leading inwards the distance of three-quarters of an inch, the *meatus auditorius externus.* He would show us a membrane stretched across the bottom of the tube, like the head of a drum, the *tympanum.* Beyond this he would lead us into the middle ear, a cavity into which he would show us an opening from the throat by a tube, called after its discoverer, Eustachius, the *Eustachian tube.* In this cavity he would indicate four minute muscles for the regulation of the tympanum and three small bones, the *malleus*, *incus*, and *stapes*, the hammer, anvil, and stirrup,—so named from likenesses to those instruments,—stretching across in a connected line from the inner surface of the tympanum to an opposite surface in which are two small openings each covered with a membrane, and on one of which membranes the foot of the stirrup is planted. This middle ear, he would tell us, is the *tympanic cavity*, the opening into it from the throat being intended to keep up a balance of air on both sides of the tympanum, so that the tympanum may vibrate freely, without pressure from within the cavity. Next he would take us into a third and innermost recess of the ear, the part which the older anatomists, in their admiring wonder, called the *labyrinth*, and which is indeed to this day a labyrinthine mystery. He would point out to us in this internal ear two nervous surfaces; one spread out on membranous tubes filled with fluid, *endolymph*, enclosed in three semicircular canals; the other spread out on a fine membrane laid on a spiral layer of bone, the *cochlea* or shell. From these nervous expanses, so singularly formed, he would show us the origin of another nerve of sense, the *auditory* nerve. He would trace this nerve for us out of the temporal bone, through an opening in its hard, or petrous part, the *meatus auditorius internus*, into the cavity of the skull; and, he would finally trace the nerve, which he would tell us is like a nervous trunk of the great sympathetic chain in its consistency and construction, first by an obvious tract into the substance of the brain, and after-

wards, as some suppose, into the organic chain of nerves. This mechanism we should perceive is all for condensation and transmission of sound. Under the vibration of the external air the tympanum vibrates. The vibration of the tympanum is communicated through the middle ear and the membranes at the back of it to the nervous expanses in the labyrinth. The nervous expanses receive the vibrations, and through the auditory nerve transmit them to the sensorium. Membranes, muscles, bones, fluids, nerves, all play their parts in this exquisite physical mechanism. These parts, again, are fed from blood passing into them by minute blood-vessels; and these blood-vessels are regulated and governed by nervous force.

Passing from the ear to the sense of smell, our anatomist would show to us, within the cavity of the nostril, an elaborate surface of nervous membrane laid out to receive the ultimate filaments of another pair of nerves of special sense, the *olfactory* nerves. He would trace up these nerves, one on each side, into the cavity of the skull. Here he would expose for us two enlargements of these nerves in their course, the olfactory bulbs, from which the nervous filaments descend to the nostril; and he would follow the nerves back in their tract until they are lost in the substance of the brain.

In this mechanism we should see a simpler means for obtaining an impression than was presented in the two other senses. If we passed to the organ of touch we should find that simpler still, for there we should discover an ordinary nerve endowed, at its termination, with a minute ganglionic structure for receipt of impressions; while in the sense of taste even this modification is absent,—a common sensitive nerve, spread out on the mucous surface of the tongue and palate, doing the special work. But in every instance, simple or elaborate, we should find the principle to be the same.

We become conscious, at once, as we learn these various parts of the different organs that very slight changes in them are sufficient to make varieties of disease. If the collecting surfaces be injured the function of the organ must be perverted or destroyed. If the receiving surface of the organ be damaged or made imperfect for reception in any way, the function of the organ must be deranged. If the transmitting nerves between the receiving surface and the brain be interrupted or obstructed, the function of

the organ must be disturbed or suspended. If the brain at the point of reception be affected, however perfect all the other parts may be up to that point, the impression from the senses must be imperfectly appreciated. Injury to an organ of sense may moreover be indirectly injurious to other organs or parts. One eye is easily affected, sympathetically, from injury to or disease of the other eye. But of all organs the ear is that which excites the widest range of physical sympathy. Derangement in the ear may be communicated, by sympathetic nervous agitation, to all the body. The body may be actually stunned by sound. Every vibration of a harsh and shrill nature "goes through the body," as it is said, with pain and suffering; while pleasant sounds, sounds of beautiful music, thrill every nerve and make the body dance with pleasure and delight.

The Absorbent and Glandular System.

The absorbent and glandular system is made up of a series of tubes and of masses of fleshy-looking matter which are called *glands*, and which are dispersed over various parts of the body. If we continued our plan of looking through the man we should see glands in every cavity of the body, and beneath the skin in many of the external parts, as in the arm-pits, groin, and neck. In the structure of the skin itself we should discover, deep down in it, many thousands of small sweat glands.

In this display of structure we should be first impressed by the fact that there are various kinds of glandular systems in the body. We should see one system, quite distinct in itself, possessing its own proper vessels or tubes connected with its glands, and charged with a fluid either of a limpid or of milky character. This our anatomical teacher would tell us is the *absorbent or lymphatic glandular system*. We should discover next a series of glands connected with the vascular system and seeming to be made up of arterial vessels from which they derive all their fluids, and this system we should be told is the *vascular glandular system*. Looking still closer at the vascular glands we should see that they are of various kinds. In some we should find an artery entering and a vein coming out of the gland, but no other tube. These are called *ductless glands*. In others we should see an artery entering the gland, a small vein coming out of it, and,

in addition to the vein, a new tube which is called a duct. These are *duct glands.*

Analyzing the facts further, we should detect that the duct glands do not return all the blood they receive from their arteries by veins, but yield by their ducts a new fluid, which, like the fluid that flows from the duct of the gland called the liver,—the bile,—may be going forth to be partly taken up again into the blood,—*a secretion :* or like the fluid from the kidney,—the urine, —may be entirely an excrementitious fluid going out of the body, *an excretion.*

Thus we should see in the glandular system absorbent glands and vascular glands. Of the vascular glands we should see duct-less glands, and glands with a duct. Of the duct glands we should see some which are secreting fluids that are about to be applied to the purposes of the economy; others which are excreting fluids that are no longer of use in the economy, but require to be voided.

Tracing out the absorbent glands, we should find them to be connected with a series of vessels called the lymphatic, or lymph-collecting vessels. In the body these vessels would be seen to rise independently of the vascular system, and after coursing a distance along a limb or part, in the connective tissue beneath the skin, conveying a white lymphy fluid, into a gland ; from whence, by a new tube, the course, perhaps through other glands in line, would be towards the heart. Finally the system of absorbent tubes from all parts, gathering together near the heart, would be seen to pour their fluid or *lymph* into one of the large veins close to the heart itself, where the lymph mingling with the blood enters the circulation by the right auricle.

In the intestinal canal the absorbent vessels would be seen to rise from what are called the villi of the small intestine. Here, rising by an immense number of radicles, they would be observed to form into tubes, *lacteals*, which convey a milky fluid derived from the digested food, and, running along the folds of the mesentery, to enter a series of glandular masses called the mesenteric glands. Elaborated in these glands, and transformed into *chyle*, a fluid now containing white cells, we should see this fluid passing out of the glands by an exit tube, and through other tubes on towards a point a little below the middle half of the spinal column. At this point the tubes from the mesenteric glands all col-

lecting into a small receptacle, the *receptaculum chyli*, become one tube, the *thoracic duct*, which makes its way, as we should discover, in the line of the spinal column, towards the heart, to enter with the other lymphatic currents into the venous system and into the circulation, by the right auricle.

Turning from the absorbent glands to the vascular, we should be puzzled about the ductless glands. We should find four of these deserving our special notice. One in the front of the neck, called the *thyroid*, the gland that is enlarged in cases of "full neck," or "goître." Another, very large, in the cavity of the abdomen, the *spleen*, the gland that is enlarged to form what is called "Ague cake;" and two others, one on the upper part of each kidney but separate from it, the *suprarenal capsules*. Our anatomist would tell us that as the blood courses through these ductless glands it is changed for some important purpose, the precise nature of which change he cannot define.

Turning, lastly, to the vascular glands with ducts we should find, in each case, a vascular and tubular system, with a secerning or separating cellular arrangement, and with a rich nervous supply for regulating the amount of secretion or excretion. The salivary glands we should see secreting saliva; the stomach glands gastric juice; the pancreas pancreatic juice; the liver bile; the lachrymal gland excreting tears; the skin glands sweat; the kidneys urine; the glands of the mucous surfaces the fluid excretions of the bronchial passages and of the intestinal canal.

Shall any derangement take place in these systems of glands the effect on the body is, of necessity, marked in various ways and forms of disease. If the absorbent glands fail to act, there is loss of supply to the blood, and therewith exhaustion and wasting. If they absorb what is foreign to them, there is poisoning by the absorption. If the ductless glands are perverted in action, there is set up several kinds of obscure, but serious diseases: goître; white blood cell disease; bronzed skin disease,—Addison's disease. If the secreting glands either fail or overwork there is direct irregularity of their physiological function and power. If the excreting glands fail, there is retention in the body of water and of various excrementitious, or, it may be, poisonous products; while if they overact, there is catarrh or flux, and exhaustion from that cause. Finally the condition of the glandular system is of special importance, from the circumstance that the secretions derived from

the secreting glands are apt, under some conditions, to become themselves poisonous, and in this manner to be the promoters of diseases that are communicable. Thus the saliva of the rabid dog is a virulent poison; the secretion which produces the specific disease syphilis is a virulent poison; the nasal secretion of a glandered animal is a virulent poison; and, the same may be said of other glandular fluids, as we shall ultimately discover.

The Muscular System.

Keeping our minds still on the living man, we should see in him a set of organs that, under various impulses, are excited to movements by which parts of the body, as the limbs, or the whole of the body, may be moved. These the anatomist would tell us are the *muscles* or muscular organs, the engines of the organism. He would explain that in the body there are three classes of muscles. One class made up of the ordinary red muscles of the limbs and trunk, which we can order to work when we like,—the *voluntary* muscles. A second class composed of muscles of similar construction, but only partially or indirectly under our will, the heart and the muscles used in breathing,—the *semi-voluntary* muscles. A third class composed of white muscular fibres, delicate in structure, which surround the intestinal tube, the stomach, the bladder, and the arterial blood-vessels, which do not act under the direction of the will, but which keep the vegetative life going, independently of ourselves, our business, or it may be our inclinations, —the *involuntary* muscles. The anatomist would show us that the voluntary and semi-voluntary muscles are composed of bundles within bundles of fleshy fibres surrounded by membranous sheaths, which fibres are ultimately made up of disks that lie upon each other in lines or striæ. He would exhibit to us a beautiful net-work of blood-vessels in the muscular structure, and an equally fine distribution of nervous filaments. He would show how when a nerve current, directed by the will from a nervous centre, enters the voluntary muscle, the organ is at once contracted or shortened, producing motion; and he would define, as the difference between this form of muscle and the involuntary muscular fibres around the visceral organs and the arteries, that the organic muscles have no true muscular striated elements, and that the nervous supply which moves them is not from the will but is rhythmical and automatic. Again, he would show this difference between the

voluntary and semi-voluntary muscles, that although both are nearly alike in structural character, the nervous direction, in the semi-voluntary muscles, as in the involuntary, is mainly rhythmical and automatic.

Shall any change in function occur in the muscular action, the derangement in the system at large must needs be marked. If a voluntary muscle ceases to obey the will, if it contracts without the direction of the will, then it is *convulsed* or *tetanized;* if it will not contract, but remains quiescent when the will bids it move, then it is *paralyzed.* If the involuntary muscles respond to an unnatural stimulus, so as to become convulsed or tetanic, the parts they surround are contracted. By such contraction the blood in the arteries may be obstructed or cut off; the intestinal canal may be thrown into the painful spasm called colic; the pupil of the eye may be contracted. If the involuntary muscular fibres fail to respond to their natural stimulus, if they are relaxed by the action of some agent, such as alcohol, or extreme cold, or physical injury, then the parts they surround may be paralyzed, and the blood-vessels injected with blood until the surfaces they supply are intensely reddened, congested and inflamed.

The Osseous, or Bony System.

We should observe as we kept up our observations of the living man that all the parts of him which we have had before us up to the present time,—digestive organs, circulatory organs, breathing organs, nervous system,—organs of sense, absorbent vessels, glands, muscles,—are placed upon, or are enclosed in, a passive system of organs, which, combined into one great system, is denominated *the osseous*, or the skeleton.

The anatomical teacher, wonderfully at home in this system, will declare it to be the groundwork of the body. He will describe it as divided into the skull, the trunk, and the limbs. He will divide the skull into the head and face; the trunk into the spinal column, thorax, and pelvis; the upper limbs into the clavicle or collar-bone, the scapula or shoulder-blade, the humerus or arm-bone, the ulna and radius or fore-arm, the carpus, metacarpus and phalanges,—finger-bones,—or the hand; the lower limbs into the femur or thigh-bone, the patella or knee-pan, the tibia and fibula or leg-bones, and the tarsus, metatarsus and phalanges,—toe-bones,—or the foot. He will describe the various kinds of

joints. He will enter into the subject of structure and explain how the hardest bone is really built on a vascular net-work. He will tear off from the bone a portion of strong membrane,—*periosteum*,—will tell us that this membrane is supplied with nerves, by which it is rendered extremely sensitive, and that by it the bony structure is secreted. He will also explain that the structure of bone is made up of earthy and animal matters in such proportion as to give solidity, but with sufficient tenacity to prevent brittleness or easy fracture.

Shall these bones be subject to injury or local disease, there will be acute pain, shock, and some inability of movement of the body; shall there be much exposure of bone to air, there will be decomposition; shall the parts which make up the bone be disarranged so that the earthy matter is in excess, the bone will be brittle and will easily break; shall the organic matter be in excess, the bone will bend or give way so as to produce deformity, and will fail to sustain, naturally, the structures it was intended to support.

The Membranous System.

Our last survey would extend to those surfaces of the body of the living man which constitute the membranous system. The anatomist would point to the skin as the most obvious of those surfaces. He would tell us that this skin surface consists of two layers, one of outer or scarf-skin, made up of dead and flattened cells, and forming a negative protecting cover on which corrosive substances have little action, *the epidermis;* and of another or deeper layer of true skin, the *derm* or *derma.* In this true skin he would show to us blood-vessels, nerves, papillæ rising up to give the ridges of the skin which are so plainly seen in the hand and other parts, and the open tubes of the perspiratory ducts which, passing in spiral or corkscrew-like fashion from glands beneath, pour out the cutaneous watery excretion called sweat.

Beneath the derma he would also show us another membranous layer, partly belonging to the skin, a layer of connective tissue, in which we should find embedded the sweat-glands, a number of fat glands, and in many parts a number of small follicles or folds, in each of which a bulb of hair is planted,—*hair follicles;*—and thus he would incidentally teach us the fact that the hair is an

appendage of the skin. The same fact he would afterwards show us to hold good in regard to the nails.

We should gather from this demonstration that the skin is more than a protective elastic covering of the body. We should find that it is also a vast excreting surface; that it excretes carbonic-acid gas and acid fluids,—formic and lactic acids,—that from it an immense quantity of water, taken into or produced in the economy, is disposed of, insensibly, by evaporation; and that, in truth, the equalization of the temperature of the body is mainly regulated by the excreting action of the cutaneous sheet which envelops the body.

From the membranous outer enveloping skin our attention would next be directed to that internal membranous lining which, commencing from the skin and seeming to be, as it really is, a modification and continuation of the skin, is called the red or *mucous membrane.* As we looked at the face of the man before us we should be informed that where the skin terminates on the eyelids the mucous membrane begins, and that the outer part of the ball of the eye, all of the ball that is visible, is covered with a layer of mucous membrane called, technically, the *conjunctiva.* It would be demonstrated that the inner margin of the mucous membrane, continuous from a series of glands situated under the delicate cartilages of the eyelids and receiving watery secretion from them, is continuous also with the little duct,—the lachrymal duct,—which runs down from the inner angle or corner of each eye, into the nasal cavity, to convey away the tears. If we turned from the eye to the ear, we should find that at the point entering the ear, at the point where the skin ends, the mucous membrane begins, and that extending into the ear it lines the external meatus or passage and the outer side of the drum. Here, too, we should find the membrane supplied with minute glands for producing secretion.

The most extensive tracts of mucous membrane would be described to us, however, when we came to look at the tract which commences where the skin terminates in the lines of red membrane at the margins of the nostrils and the lips. In those red lines we should be made to recognize the beginning of the great *pulmonary* or *bronchial*, and of the *intestinal* tracts of mucous membrane. In the nostril the membrane would be observed to

cover the nasal cavity and to become continuous with the conjunctiva through the lachrymal duct. It would also be seen to continue to the back of the throat. In the mouth the membrane would be detected as covering all the inner surface to the throat and as extending at the back, on each side, along the Eustachian tube into the cavity of the internal ear, lining that also. From the throat, the mucous membrane, continuous from the mouth and nose, would be observed as extending in two directions. In one direction it would be seen passing down the chink of the glottis into the windpipe and thence through both lungs, lining the bronchial tubes throughout all their course and dipping into the structure of the bronchial follicles, or small glandular folds which yield the bronchial secretion, to the bronchial surface. In the other direction it would be seen extending down the pharynx or expanded upper part of the alimentary canal; along the œsophagus or gullet into the stomach; from the stomach through the duodenum, jejunum, ileum, cæcum, colon, and rectum; and so on quite through the canal to terminate by again joining with the surface of the skin. In this course through the alimentary tract we should learn that the mucous membrane is everywhere in contact with glandular structures, dipping into the ducts of those structures and forming their inner tubular coating. In the throat this glandular plan would be seen to be follicular; in the stomach,—where the gastric juice is produced,—tubular. In the first part of the small intestine the mucous membrane would be found dipping in so as to line the tubular ducts and passages from the pancreas and liver; in the other parts it would be observed lining all the small intestinal mucous glands that open into the canal and afford a secretion.

Nor would the course of the mucous membrane end with these views of the pulmonary and the alimentary tracts. We should observe that again from the skin there proceeded a tract of mucous membrane along the passages leading to the bladder; through and from the bladder to the small tubes, the *ureters*, which convey the urine from the kidney to the bladder; to the kidneys and on through the tubular excretory structure of the kidneys up to the cusps containing the vascular tufts from which the renal fluid is derived.

We should thus, in the end, be led to the conclusion that all the parts of the body are enclosed in these two kindred mem-

branes, the skin and the mucous membrane, and should readily keep in mind their continuous and intimate relationships the one to the other.

There would still remain for us to recall this further fact relating to the membranous system, that all the organs of the body are individually enveloped in membranes proper to themselves. The brain and spinal cord, we should remember, as being invested with three membranes, the *pia mater*, *arachnoid*, and *dura mater:* the bones, in their outer parts, with *periosteum*, in their joints with *synovial* membrane: the heart with the *pericardium:* the lungs with the *pleura:* the liver, stomach, intestines and bladder, in great part, with the *peritoneum:* the kidneys with a fine capsule or covering of their own, the *renal capsule.* These membranes would also be found either to be strong and fibrous like the dura mater; or fibro-serous like the pericardium; or serous and singularly sensitive to pain, like the peritoneum and pleura.

Our observations on the membranous surfaces would not be ended until it was demonstrated to us that the whole of the organs of the body are knitted together by a thin web of tissue, called the *cellular* or *areolar tissue*, which so intimately interposes between each separate structure, that if air be blown into it every organ of the body can be separated by a coating of air from every other organ. This tissue, elastic, interweaving, binding, is seen in all parts except in the serous bags and in the mucous canals. It lies between the skin and the muscles; between the muscles themselves; surrounding the glandular masses; filling vacant spaces between organs; connecting organs; and in many of the spongy organs making up the chief portion of their structure.

Shall anything interfere with the functions of these membranous surfaces, disturbance of the bodily functions must result, and that to an extent often little appreciated. Shall the pores of the skin be blocked up by dust and dirt, the evaporation from the body will be reduced, and the lungs, liver, and kidneys will at once have thrown upon them some extra or vicarious labor it was not their duty to perform. Shall the skin be clothed with an impermeable covering so that evaporation be generally checked, the same derangement will be presented in a more marked, nay, even fatal degree. Shall the excretion of free acid by the skin be suspended, there will follow a dyspeptic condition and rheu-

matic tendency. Shall the skin be subjected to great irritation or injury, the sympathetic shock and reflected nervous agitation will extend through the nervous system in the most decisive manner. Shall the follicles of the hair become filled with purulent or fatty substance, there will be a destruction which may be as painful to the sufferer as it is offensive to the observer. One more peculiarity we shall gather in relation to the skin and disease. We shall learn that the skin is the special surface on which many of the specific characters of the epidemic and contagious diseases are so legibly written that these diseases are often named by their mode of eruption upon the skin, and are called eruptive diseases. Lastly, we should learn that the skin is, for many reasons, the frequent temporary residence of various parasitic growths, animal and vegetative; that some of these growths destroy the upper or scarf-skin, laying bare the sensitive under-skin; that others bore beneath the surface and while they are present keep up a constant irritation.

Shall disease occur in the course of the great tracts of mucous membrane, the disturbance excited will be acutely or slowly demonstrated. Every condition of disease which we designate by the name of a catarrh or flux, and which is attended with the discharge of phlegm or mucous fluid, is an affection of a mucous membrane. A cold in the eyes, in the throat, in the bronchial tubes, in the stomach, in the intestine, in the bladder, is an affection of mucous membrane. The inflammations that occur in the same parts and the ulcerations that may succeed, are inflammations and ulcerations of mucous membrane. The irritations that occur from foreign substances lodged in the alimentary canal and which when long continued lead to convulsions, as in the convulsions so common during childhood, are primarily irritations of mucous membrane reflected from the irritated spot, through the nervous system, to the muscular organs.

Shall disease occur in the fibrous or serous membranes, all of which are subject to irritation, inflammation, over-secretion, dryness, thickening, and even transformation into new structure such as bone, the evils resultant must, it will easily be conceived, be serious in the extreme, first to the vital organs enveloped by the membranes, and next to the body at large. The dropsies are accumulations of fluid in the membranous pouches. The inflammations that are most acutely painful, pleurisy, peritonitis, are inflammations of the delicate and sensitive serous surfaces.

Lastly, if the connective or areolar tissue, that wonderful web which binds together all the organs and parts so intimately, is the seat of disease, the danger may and often does become rapidly universal. Through this web-work gases and fluids diffuse as through a vast sponge. Through the meshes of it poisons can pass, practically, without interruption over all the organic surfaces. The watery part of the blood accumulating in it produces anasarca, general dropsy, until the pressed skin above indents like dough. Air diffused through it produces the disease called emphysema of the cellular tissue. Pus or matter burrowing through it, produces circumscribed inflammation,—carbuncle, or diffused phlegmonous inflammation,—erysipelas. It is the seat of many tumors and diseased growths, and is perhaps the mother of them all.

And now our general survey concluded, we may pass to the study of the local diseases belonging to the great organic systems which have been made the subject of our observations in the present chapter.

CHAPTER II.

DISEASES OF THE DIGESTIVE SYSTEM.

In studying the local diseases of mankind we cannot do better than take them in order as affecting the different systems of organic parts we have just considered. The local diseases, the reader may be once more reminded, are, for the most part, but repetitions of the conditions of disease and of the general diseases, locally situated. We commence, therefore, following our physiological outline, with the diseases of the alimentary or digestive system of organs.

The different parts of the alimentary system are, as we have seen, (*a*) The lips, mouth, tongue, fauces or back of the throat, and palate, with the uvula and tonsils. (*b*) The pharynx, or dilated pouch at the back of the throat, ending in the œsophagus or gullet, the tube extending from the pharynx to the stomach. (*c*) The stomach, or first digesting receptacle, in which the albuminous or flesh-forming foods are transformed into chyme, primary digestion, to be passed through the pylorus or exit gate of the stomach, into the duodenum. (*d*) The duodenum, or first portion of small intestine into which the liver pours its bile and the pancreas its emulsifying juice, under which the fatty and starchy portions of the food are digested,—secondary digestion,—before being carried into the small intestines. (*e*) The small intestines, jejunum and ileum, in which digestion is completed, and from which the prepared food is absorbed into the blood. (*f*) The large intestine springing from a pouch, the cæcum, for receiving the *débris*, undigested or useless part of food substances, and the gases arising during digestion,—the colon. (*g*) The straight intestine, with the outlet of which the canal is terminated. (*h*) The mucous membrane lining the whole of the canal internally. (*i*) The peritoneum or serous membrane of the abdominal cavity, in

which the intestines and other abdominal organs are in great part enfolded, and which lines also the walls of the cavity.

All these parts are seats of local disease.

Diseases of the Lips.

Ulcer of the Lip.—A small round ulcer by which the mucous membrane is destroyed in a circular manner so cleanly that it looks as if a portion had been punched out, the cellular tissue beneath forming the lower part or base. The ulcer is often exceedingly painful, and frequently recurs in those who are liable to it.

Fissure.—A cleft in the mucous membrane of the lips running longitudinally, often occurring in the middle of one lip, and most frequently in the lower lip. As a rule the fissure is painful, slow to heal, and apt to recur.

Cancer.—Cancer usually of the form called epithelial, occurring mostly in the lower lip, and excited in many cases in those who are addicted to smoking by irritation from the stem of the pipe. The disease not unfrequently affects men, but so rarely affects women, that in thirty years of medical observation I have not seen one instance of it.

Cysts.—Small cystic or hollow tumors attached to the mucous surface of the lips.

Harelip.—A malformation in which the upper lip has not been developed in such way as to unite in the centre previous to birth, so that there is a deep cleft down the lip. The malformation is now remediable by surgical art.

Diseases of the Mouth and Tongue.

Stomatitis.—A diseased condition of the mouth to which infants or young children are most subject, in which the mucous membrane is more or less covered with whitish flaky-looking spots or patches.

Follicular Stomatitis.—A catarrhal inflammatory state of the follicles or little sacs of the mucous surface.

Ulcerative Stomatitis.—A series of small ulcerations of the mucous surface involving the follicles.

Thrush. Vesicular Stomatitis.—Stomatitis in which there is a vesicular eruption of thrush on the mucous surface.

Parasitic Thrush.—Thrush in which there is present the parasite called oidium albicans, or thrush fungus.

Cancrum Oris, Canker of the Mouth.—A form of stomatitis in which there is death or mortification of the mucous membrane. The disease is sometimes called gangrenous stomatitis.

In all these local forms of disease there is some pre-existing general disease and weakness of the body, the common cause of which is improper feeding. Thrush most generally precedes death in exhausting diseases, and is, as a rule, a fatal symptom.

Abscess.—A circumscribed accumulation of matter or pus in the structure of the cheek, the result of inflammation.

Cyst.—Growth of a hollow or cystic tumor beneath or upon the mucous surface of the cheek.

Ranula.—A cystic tumor beneath the tongue, sometimes, but not always, connected with destruction of one of the ducts which convey the saliva from the salivary gland into the mouth. It is occasionally attended with a deposit of phosphatic concretion or calculus, derived from the saliva.

Diseases of the Gums.

Inflammation.—Inflammation of the firm structure which, covered with mucous membrane, extends over the alveolar part, —socket part,—of the jawbone up to the commencement of the crowns of the teeth. When the inflammation is caused by a decayed tooth, and involves the periosteum of the fang of the tooth, the term *gum boil* is employed to express the disease.

Ulceration.—A destruction, by ulceration, of the surface of the gum from irritation or inflammation.

Hypertrophy.—An excessive growth or thickening of the structure of the gum.

Atrophy.—Wasting of the structure, often called, in advanced life, shrinking of the gums.

Induration.—Hardness of the structure of the gum; a condition which, occurring in infancy, causes much pain and difficulty in the process of cutting the teeth.

Tumors.—Growths, malignant or non-malignant, attached to or springing from the structure of the gum. The cancerous or malignant growths are usually epithelial. The simple or non-malignant are of four kinds. (*a*) Polypoid. (*b*) Cartilaginous. (*c*) Vascular. (*d*) Fibrous, called sometimes epulis.

Perforation of the Palate.—The palate, the bony structure forming the roof of the mouth and, in the natural state, covered

with mucous membrane, is said to be cleft or perforated when from irregular development before birth the two parts of which it is composed have not come together. The condition is sometimes accompanied with cleft or harelip.

Diseases of the Tongue.

Glossitis.—Inflammation of the structure of the tongue, an acute disease of rare occurrence.

Ulceration.—An ulceration of the mucous surface of the tongue assuming different forms. (*a*) Small round ulcers like those seen on the lips, or taking the form of a cleft. (*b*) Wider spread, more irregular shaped, deeper ulcers. (*c*) Aphthous ulcers, ulcers accompanied with aphthæ, often of parasitic character.

Abscess.—A circumscribed accumulation of matter or pus in the structure of the tongue, the result of inflammation. A disease of comparatively rare occurrence.

Hypertrophy.—A partial or general enlargement of the tongue, the organ sometimes assuming a great size from interstitial deposit between the muscular fibres of which it is composed.

Cancer.—Malignant disease commencing in the tongue, usually in the epithelial form of the malady, but taking, sometimes, the hard or scirrhous type.

Vascular Tumors.—Various forms of tumors, made up mainly of arterial and venous vessels, and attached to the tongue from its cellular or connective structure.

Cellular Infiltration.—A condition I have observed and described, in which the whole cellular structure of the tongue has become infiltrated with diseased serous fluid as the result of inoculation, through a wound in the tongue, of decomposing animal substance taken as food. The tongue is greatly enlarged so as to protrude from the mouth, is of soft spongy consistency, and completely infiltrated with a serous, milky-looking decomposing fluid.

Paralysis.—The tongue often shares with the lips and other parts of the body in paralysis. In rare instances it is subjected to paralysis of motion independently of the rest of the body.

Tongue Tie.—A malformation in which, from prolongation of the little central band called the frænum, the tongue is tied down to the lower jaw.

Exfoliation of the Mucous Membrane.—In some dyspeptics, especially in persons who smoke excessively, the tongue is sometimes coated with a thick white fur, which peels off, carrying with it the epithelial surface and leaving an irritable red surface beneath.

Diseases of the Throat.

The part of the mouth called the fauces, the back of the throat, is commonly injected, inflamed, and ulcerated in the course of some acute febrile affections, such as scarlet fever. It is also subject to several purely local affections. The following are the more important:

Sore Throat.—A diffuse injection of the mucous membrane of the throat, with raised points, accompanied by a sense of soreness, heat, and dryness, but without exudation of any membranous substance. The affection is a frequent attendant of a common cold,—cold and sore throat,—and may be associated with some degree of temporary deafness and feeling of pressure on the drum of the ear. The Eustachian tube, which extends from the throat into the middle ear, is then also affected.

Relaxed Throat.—A state of the mucous membrane of the fauces in which, with redness and irritation, there is a relaxed condition of the mucous membrane, with projecting folds of membrane which are often, at the same time, large and relaxed. The condition follows usually upon cold and sore throat, but it may be induced by mechanical causes, such as severe hoarse cough, screaming, shouting, frequent reading in one harsh tone, and overstrain in singing. It is induced also, in persons who are susceptible to it, by no means an inconsiderable number, by smoking tobacco. It is more frequent in men than in women, and specially in men who are engaged in occupations in which the voice is employed in one strain. Thus to one chronic form of this affection the term "clergyman's throat" is applied, because it affects numbers of the clergy who, while in indifferent health, read the services of the Church and preach too frequently.

Ulcerated Throat.—A condition in which the mucous membrane of the throat is in parts destroyed so deeply in bad cases, that the connective tissue beneath it may be seen. It is the result, as a rule, of inflammation of the mucous membrane or of specific disease.

Quinsy. Cynanche. Cynanche Tonsillaris.—An inflammation ending often in formation of matter in one or both tonsils. The disease is usually brought on by cold, and occurs most frequently in the young. It is strongly hereditary.

Tonsillitis.—Sometimes called follicular tonsillitis. A superficial inflammation of the tonsils common in childhood. The tonsils are swollen, but the inflammation is on the surface, and matter does not form in the substance of the tonsil. The disease is apt to assume a chronic form in children who are badly fed, or who are of weakly constitution.

Hypertrophy.—Enlargement, or hypertrophy of the tonsils, from repeated or long-continued chronic inflammation. The enlargement may be so marked and persistent that the tonsils may have to be removed altogether by operation.

Cynanche Maligna.—Called also sloughing sore throat or putrid sore throat. A low and dangerous form of inflammation of the tonsils, attended with death or putrefaction of the mucous membrane and sloughing of the tonsil itself, there being no attendant scarlet fever. The disease seems at times to have taken an epidemic character, but has not been shown to be contagious. It is not so common now as it was in past days.

Other Affections.—The tonsils, in diphtheria, may be swollen and covered with diphtheritic false membrane or spots of false membrane. The tonsils are occasionally the seats of cancer. Finally the tonsils are often enlarged and irritable in persons of scrofulous taint, so that chronic enlargement is, by some, believed to be an indication of that taint. When connected with scrofulous swellings in other parts of the body, enlargement or abscess of the tonsils is called scrofulous disease of the tonsils.

Elongated Uvula.—An enlarged condition of the uvula, with elongation, so that the inverted apex of the structure descends into the throat and is a cause of irritation, with some difficulty of swallowing and occasional sense of choking and cough.

Stricture of the Fauces.—Contraction of the back of the throat, sometimes from accident, as from drinking of scalding water; at other times from severe inflammation; and again from malignant disease.

Tumors of the Fauces.—There are several varieties of tumors affecting the fauces:—Malignant or cancerous growths; fibro-cellular and fibro-cystic non-malignant growths; specific growths;

the mucous covering of the fauces being the seat of syphilitic ulceration in persons who are under the taint of that specific disease.

Diseases of the Pharynx.

Pharyngitis.—Inflammation of the mucous membrane of the pharynx or expanded part or pouch lying between the fauces and the commencement of the gullet or œsophagus.

Ulcer.—Ulceration of the mucous surface of the pharynx. There are two varieties:—(*a*) Superficial; the ulceration being on the surface only. (*b*) Perforating; in which the ulceration extends through the mucous membrane or even through the coats of the pharyngeal tube entirely.

Abscess.—A circumscribed accumulation of matter or pus in the structure of the pharynx.

Tumors.—Tumors or growths affecting the pharynx; of which there are the same varieties as above named in respect to the fauces.

Other Affections.—The pharynx is subjected to other forms of disease. Sloughing of the mucous surface. Dilatation. Adhesion of the soft palate. Injury by scalding and by corrosive substances. Syphilitic ulceration. Impaction of foreign bodies. Paralysis. Constriction of the pharynx, stricture, is an occasional disease usually the result of accident.

Diseases of the Œsophagus or Gullet.

Œsophagitis.—Inflammation of the mucous membrane of the tube extending from the pharynx to the cardiac end of the stomach. The inflammation is generally the result of an accidental swallowing of some irritant; but it may arise from erysipelas of the throat, or from inflammation extending from the throat or the stomach. The disease is of rare occurrence.

Ulceration.—An ulcerated condition, localized in the œsophageal tube and involving the mucous surface. The ulceration is of two kinds:—(*a*) Superficial; involving the mucous surface only. (*b*) Perforating; the ulceration extending more deeply, so as to cause, in the extreme form of the affection, perforation through all the coats of the tube.

Stricture.—A condition in which the gullet is constricted at one or more points, so that foods and drinks are swallowed with

difficulty, or are prevented from being swallowed altogether. There are several varieties of stricture of the œsophagus.

Spasmodic Stricture.—Stricture in which the obstruction is due to simple spasm of the œsophageal tube. A condition often connected with hysteria, and, though alarming for a time, recoverable as a general rule.

Traumatic Stricture.—Stricture in which the constriction has been caused by irritation and inflammation due to an injury inflicted on the œsophageal surface in some part of its course, as by the swallowing of scalding water, or of corrosive substances. A condition in which the act of swallowing may be rendered permanently difficult, but in which the mischief need not, necessarily, become fatal.

Simple Organic Stricture.—A form of the disease in which there is simple thickening of the tube at some part, without tendency to ulceration.

Malignant Organic Stricture.—The most common form of stricture of the gullet. The affection comes on in persons subject to the hereditary taint of cancer. It is excited originally, in most instances, by some accidental irritation. The malignant manifestation takes at least two distinct forms. It is sometimes of a firm or cartilaginous character; at other times it is of an ulcerative character. It is most common in the upper third of the tube, but may be developed in two or more points at the same time. I have seen it in three. The tendency is to progress to a fatal issue, either by producing a complete obstruction or by an ulceration extending through the tube, perforation.

Dysphagia.

Difficulty in swallowing. The term is applied generally to indicate difficulty in swallowing from any cause. It is also applied to express difficulty arising from spasm or other mere temporary state by which the act of swallowing is impeded. Literally it means swallowing badly, and is rather a definition of a symptom than of any particular disease.

Diseases of the Stomach.

Gastritis.—Inflammation, acute or chronic, of the lining membrane of the stomach. There are several varieties of gastritis.

Simple Catarrhal Inflammation.—A temporary and slight in-

flammation of the gastric mucous surface, attended with pain, thirst, some fever, and sometimes bilious vomiting.

Acute Inflammation.—Inflammation occurring without an obvious external cause ; attended with pain, sensation of sinking, vomiting and fever, with tendency to sudden collapse.

Traumatic Gastritis.—Acute inflammation of the mucous surface, arising from the swallowing of scalding or corrosive substances.

Gastro-Enteric Inflammation.—Inflammation of the stomach coincident with inflammation in the intestinal canal. A condition occurring during the existence of intestinal or enteric fever, and adding seriously to the dangers of that complaint.

Ulceration.—Ulcerative destruction of the mucous membrane of the stomach and of adjacent structures. There are five varieties of this ulceration.

Small Defined Gastric Ulcer.—An ulcer of the mucous membrane of similar character to the simple circular ulcer of the lip, and productive of much pain, especially after food.

Perforating Gastric Ulcer.—An ulcer extending deeply, but often limited and circumscribed. It extends sometimes so deeply as to perforate through the whole of the coats of the stomach and to cause death by allowing the contents of the stomach to enter the abdominal or peritoneal cavity.

Traumatic Gastric Ulcer.—An ulcer of the stomach produced by injury to the coats of the stomach, as by the swallowing of heated or corrosive fluids, and, in rare cases, by the swallowing of hard solid substances.

Alcoholic Gastric Ulceration.—A diffused ulcerated condition in which, from the long-continued action of strong alcoholic drinks taken in free quantities, the mucous surface becomes studded with small ulcerated points which often give out blood, and which always give rise to extreme dyspepsia, deficiency of appetite, uneasiness, pain, and failure of digestive power.

Malignant Gastric Ulcer.—Ulceration of the mucous surface of the stomach, from the development of cancer.

Cancer.—The stomach may be the seat of cancerous disease, especially of epithelial or diffuse, and of scirrhus or hard cancer. The cardiac part of the stomach is most frequently the seat of epithelial, the pyloric of scirrhus cancer. The disease, in either case, is, as a rule, developed in those only who are under the

taint of the constitutional malady, and both forms are, up to this time, fatal conditions of disease.

Hæmatemesis.—Literally vomiting of blood, but a term used to define loss of blood from the stomach only. Hæmatemesis may occur from extreme congestion of the vessels of the stomach, but it is most frequently a result of rupture of vessels from ulceration. This loss of blood is often extremely profuse from the stomach during the congestion and ulceration produced by the taking of alcoholic drinks.

Simple Tumors.—The stomach may be the seat of growths or tumors of the non-malignant kind; fibro-cellular, fibro-cystic, cystic, and gelatinous or colloid. The colloid tumor is by some considered malignant in character.

Parasitic Disease.—The stomach may be the seat of various forms of parasitic disease. It may be the seat of aphthous parasitic affection. It may be a point of attachment for cysts containing the larvæ of parasites. It may hold parasitic growths in its digestive and mucous fluids.

Spontaneous Laceration.—The stomach may be spontaneously torn or lacerated during some act of exertion of the body, or even during digestion of food. The accident is usually preceded by degenerative changes, during which the coats of the organ have become so weakened that they are easily ruptured.

Injuries of the Stomach.—The stomach is liable to accidental injuries. External blows over the stomach and affecting it are extremely and suddenly dangerous. Wounds penetrating the stomach are causes of great danger, although there have been recoveries from such wounds. Injuries from swallowing foreign substances of large size and irregular form, are also occasionally produced, though here again it is remarkable how much disturbance the stomach will sometimes bear. This is well seen in men who, as a feat, pass a blade or cane into the gastric cavity.

Dyspepsia.

Literally bad or imperfect digestion. A condition in which the food taken into the stomach is not naturally digested, and in which the stomach becomes either overcharged with food, or subjected to foods that undergo fermentation or other changes which are not according to nature. Pain, distention, oppression, disturbed bowels, and excitement or depression of mind, are the

leading signs of dyspepsia. Dyspepsia when it is sharp and short is said to be acute; when it is subdued and continuous, it is said to be chronic. It may be due to one or other of the diseases of the stomach itself, or to entire carelessness in loading a healthy stomach with foods and drinks which it was never intended to receive. The last-named is, by far, the most common cause of dyspepsia.

Gastrodynia.

Pain in the stomach, or pain referred to the stomach, occurring usually after a meal, sometimes periodically and acutely. The periodic form of gastrodynia is often of neuralgic or gouty character, and may alternate with attacks of tic or neuralgia in other parts of the body. It is dependent rather on constitutional than local causes. Gastrodynia occurring after food, and not otherwise periodically, is a common symptom of indigestion.

Pyrosis.

Commonly called water-brash. A sudden rising into the mouth of a thin fluid, brackish in taste, and now and then acid. The eructation often occurs early in the morning, before breakfast, and in many persons is attended by a singular sensation of exhaustion and feebleness. It is induced by alcoholic drinks, by smoking tobacco, by eating sweets,—especially such nauseous sweets as chocolate cakes,—and by oatmeal porridge. The watery matter thrown up is not always the same. It is in some cases a mere watery fluid containing the secretions of the stomach, while in other instances it contains, in addition, forms of organized growths called *sarcinæ ventriculi*, which seem to be connected with some peculiar fermentative change excited by food through which the organized particles were first introduced, and in which they have continued to be generated.

Degenerative Gastric Exhaustion.

The stomach in aged people, and in people who are prematurely aged, undergoes an enfeeblement both in its secreting power and in its muscular tone. Under this condition the functions of the stomach become imperfect and its action at last so indifferent that all desire for food ceases and the body sinks from inanition.

Vomiting.

Vomiting, though called a disease, is rather a symptom of some derangement that excites the stomach to revulsive action than a disease in itself. It may occur under any of the affections of the stomach which we have seen, as well as in other conditions, such as sea-sickness and sickness from fear or mental emotion. In the latter case the impression producing the phenomenon is primarily made on the nervous system and is reflected to the stomach.

Dilatation.—The stomach may be greatly dilated, and the dilatation may remain permanent. This is often the case in persons who for long periods daily over-indulge in eating. It also occurs in dyspeptic persons in whom the stomach is much distended with gases. In some kinds of chest disease, phthisis pulmonalis, chronic bronchitis, asthma, in which the stomach performs vicarious work by retaining and ejecting large quantities of gas, distention and dilatation of the stomach is extremely common. The stomach when permanently dilated is feeble in its contraction, and secretes the digestive fluids most imperfectly. Dilatation is a source of persistent indigestion and general derangement of the body, and is a more frequent cause of premature vital decay than is usually supposed.

Stricture.—The stomach is occasionally the seat of stricture, the pyloric end or outlet being the part most frequently constricted. The stricture may be spasmodic in character. It may be a simple thickening of the mucous membrane. It is more frequently the result of malignant disease.

Gastric Fistula.—By gastric fistula is meant a permanent opening, that is not natural, from the stomach to some other part. The stomach in this way has been made, either by accident or by operation, to communicate directly with the outside of the body through the abdominal wall, and by the opening so produced foods and drinks have been introduced into it. The process of stomachic digestion has thus been observed from stage to stage. By a gastric fistula the stomach has also been known to communicate with the intestines, and even with the bladder.

Gastric Hernia.—An accidental affection, in which the stomach protrudes through an opening in the abdomen, or through an opening in the mesenteric membrane within the abdominal cavity.

Reflex Disease from Gastric Irritation.

The stomach, richly supplied with nervous fibres, derived both from the cerebro-spinal and the sympathetic nervous systems, is a frequent centre of reflected irritation to remote organs. This is shown in the convulsions of infancy arising from stomach derangement; in that form of epilepsy of the adult called stomach epilepsy; in palpitation of the heart from distention or oppression of the stomach; and in vertigo or giddiness and faintness, from the same cause.

Diseases of the Intestines.

Enteritis.

Inflammation of the whole, or of a portion of the mucous tract of the small intestines. In some instances enteritis is a purely local affection, occurring after exposure to cold and privation. In other instances it is the result of injury, or of the passage of irritant substances with food, or of improperly-digested food, into the intestine. In a third class it is induced by sympathetic irritation, as in examples where the neighboring mesenteric glands are the seats of acute disease. Lastly, it is an accompaniment of certain forms of general disease, especially of typhoid or enteric fever. It is, in fact, so regularly a part of this fever that the word "enteric" is as often used to express the fever as the word "typhoid." In typhoid the lower part of the small intestine is the most seriously involved, the groups of mucous glands called Peyer's glands or Peyer's patches being specially affected, swollen and inflamed, or ulcerated.

In all its forms, acute and chronic, enteritis is a serious disease. The irritation keeps up a frequent discharge from the bowels, which is most exhausting. The absorption of food is interfered with, and the danger is always contingent that ulceration, proceeding to perforation of the intestine into the peritoneal cavity, will take place and will lead to an all but certain fatal termination.

Enteritis may assume a slow or chronic form, in which case the suffering person is for a long time subject to pain in the bowels, diarrhœa often attended with loss of blood, and exhaustion, ending in death from obstruction or perforation of the intestine.

Typhlitis.

Under this term the College authorities define a disease which consists of inflammation of the mucous membrane lining the cæcum or large pouch in the right lower side of the abdomen, the pouch in which the small intestine ends, and from which the colon or large intestine takes its rise. The cæcum has been called the second stomach, the idea once being that in it the final process of intestinal digestion was carried out. It is often the receptacle of food that has not been digested, and of substances, such as magnesia, taken as medicine for long periods, which do not admit of being digested, and it is to irritation caused by the presence of such bodies that the inflammation known as typhlitis is usually due. The most remarkable illustration of the disease I have met with was one in which the cause of irritation was a large concretion made up of magnesium carbonate, which drug the affected person had in early life been made to take for several months in repeated doses. The disease, acute at first, becomes chronic, as a rule, and terminates in various ways. The substance in the cæcum, as in the instance just referred to, may break up, and after much suffering be ejected by the bowels; or it may create abscess or accumulation of matter which may burst into the peritoneal cavity, or may even escape through an external opening from the body.

Dysentery.

The term dysentery is most commonly applied to define a severe epidemical, but not contagious, affection of tropical countries. The disease consists of inflammation, principally of the mucous surface of the small intestines and of the solitary glands there, followed by ulceration, and, in very bad cases, by perforation or contraction of the intestinal tube. The disease, in the first instance, is marked by choleraic discharges from the bowels followed by discharges of blood, the latter being the specific symptom. In the epidemic form dysentery is often a very fatal disease.

In temperate and cold climates dysentery rarely occurs, but persons who have lived in tropical, and have returned to temperate, climates, suffer, especially in hot weather, from symptoms of chronic dysentery. Occasionally, too, persons permanently

residing in temperate climes experience dysenteric symptoms, due to extreme irritation in the intestinal canal from the presence there of undigested food or other foreign substances.

Chronic Affections of the Intestine.

Ulceration.—An ulceration, usually from inflammation, of the lining coat of the intestine, in points, or over an extended surface. The ulceration commences from the mucous coat, and extends more or less deeply towards the external investing membranous coat, the peritoneum.

Perforation.—An ulceration or injury extending through the intestinal tube into the abdominal or peritoneal cavity.

Fecal Abscess and Fistula.—An unnatural opening, permanent in character until closed by medical art, from the intestine into some part of the abdominal cavity, or through to the outside of the body. When the fistula so formed allows the contents of the intestine to escape through it, it is called fecal fistula.

Hemorrhage and Melœna.—The intestinal canal may be the seat of hemorrhage, or loss of blood, from ulceration of the mucous coat, injury, malignant growths, or undue fluidity of blood. When blood is discharged from the bowel of a dark color or black, the term melæna is sometimes employed to express the condition of disease.

Physical Changes of Intestine.

The intestine is subject to *dilatation* in the whole or in parts of its length; to distention from accumulation of gases within it, *tympanitis;* and to obstruction from various substances lodged in it that have not been digested.

Stricture.—Stricture of the intestine is a constriction of the canal in some particular part. There are several varieties of intestinal stricture.

Spasmodic.—Stricture from a spasm, form usually temporary in character, due to irritation, and often connected with hysteria.

Inflammatory.—Stricture from inflammation of the mucous coat, followed by deposition and thickening, or by ulceration and contraction.

Mechanical.—Stricture *from pressure* on the intestine by some external growth, or by a band of membrane or adhesion surrounding or enclosing it.

Malignant.—Stricture from the occurrence of malignant deposit, cancer, in the intestinal wall.

Intussusception.—The involution of a portion of the intestinal tube into another portion, as if a piece of a thin india-rubber tube were pushed, in an involuted or folded manner, into the inner part of the tube. Intussusception as a cause of obstruction in the canal is usually of fatal character. It is, as a rule, the result of some accidental shock or strain.

Internal Strangulation.—Internal strangulation of the intestines occurs when the intestine is so tightly compressed that the circulation through it is checked and mortification is the threatened or actual result. There are two varieties:

Mesenteric.—In this form the intestine slips through a small opening in the membranous expansion called the mesentery.

Mesocolic.—In this form the intestine slips through an opening in the part of the mesentery which hangs like an apron from the transverse part of the colon. In either form the strangulation is due to the pressure or tie caused by the opening in the membrane into which the fold of bowel has slipped. The disease is usually the result of accident, and is fatal unless the detection of its nature be speedily discovered, and the resources of operative art be promptly secured and applied.

Hernia.

Whenever an organ or part of the body protrudes from the cavity containing it, pushing before it the skin of the body, hernia is said to have taken place. The term comes from *hernos*, a branch, and implies a branching out of the protruded structure. Thus protrusion of the cerebrum from the cavity of the skull is called "hernia cerebri." The word, however, is most frequently applied to protrusion of the intestines from the abdominal cavity. The intestines are the part most frequently subjected to the accident, a natural sequence from their structure, function, and position.

Hernias are divided, in the first place, according to their characters. If the hernia, or protrusion of intestine through the abdominal wall, can be put back into its cavity by pressure over the skin at the point of protrusion, it is called a *reducible* hernia. If it cannot be put back in this way, it is called an *irreducible* hernia. If it is prevented from returning by some obstacle within it-

self, it is called an *obstructed* hernia. If it has become subject to inflammatory action, it is called an *inflamed* hernia. If it is so constricted at the opening from which it has escaped that the circulation through it is prevented, it is called a *strangulated* hernia.

Hernias, again, are named after the parts which they pass through. If the protrusion is through the midriff or diaphragm, it is said to be *diaphragmatic;* if through the epigastrium, *epigastric;* if through the umbilicus or navel, *umbilical;* if through the fore part of the abdominal walls, *ventral;* if through the back part, *lumbar;* if in the groin, through the abdominal rings, *inguinal;* if on to the thigh, below the ligament that crosses obliquely from the crest of the hip to the central pubic bone, *femoral;* if through the great obdurator ligament in the front of the pelvis, *obdurator;* if through the ischiatic notch at the back of the pelvis, *ischiatic.*

The most common form of hernia is *inguinal.* The intestine in inguinal hernia slips through the weakest and one of the most dependent parts of the abdominal cavity.

There are six varieties of inguinal hernia :—

The Oblique: in which the course of the protruded intestine is obliquely downwards and inwards in the line of the inguinal canal.

The Direct: in which the protrusion is pushed out strongly, forming a direct protrusion from the cavity.

The Incomplete: in which the protrusion is not completely into the inguinal canal.

The Scrotal: in which the intestine passes quite along the inguinal canal until it enters the pouch called the scrotum.

The Congenital: in which the male child is born with the disease. The bowel descending with the testes into the scrotal bag.

The Infantile, a variety of the congenital: in which the bowel is enclosed in two adherent folds of membrane. This is also called encysted hernia.

Hernia is often produced by very slight causes: by a jerk, as in suddenly pulling open a door that sticks; by a fall; by an attempt to raise a heavy weight, or any other act which tends to bring a strain upon the intestines that shall make them bear downwards. It is also favored by many causes; by over-eating;

by over-exhausting exertion; and, by exertion during times when the body is enfeebled by disease. The affection is hereditary. It is more frequent on the right than on the left side of the body; and it is so common in civilized communities that in America during the late war one man in every thirteen men was found to be subject to it. Occasionally from strangulation of the intestine hernia proves fatal, but surgical art has reduced the dangers of death from it to a very low figure.

Diseases of the Hernial Pouches or Sacs.—When a hernia has existed for a long time it forms for itself a distinct pouch or sac out of the investing peritoneal membrane which the intestine has pushed before it. The sac so formed is, in turn, subject to local diseases, of which the following have been described. Inflammation; fibrinous exudation, with closure of the sac as a result; suppuration; dropsy; movable bodies within the sac; tear or laceration of the sac.

Tumors of the Intestines.

The intestinal canal is sometimes the seat of internal tumors. There are several varieties.

Malignant—Cancer in one or other of its forms.

Colloid or gelatinous tumor.

Non-malignant tumors and polypus.

Parasitic Disease.

The intestinal canal is often the seat of parasites, vulgarly called worms. The three common forms of parasite of this part are the *tænia solium*, tape-worm; the *ascaris lumbricoides*, round-worm; and the *oxyuris vermicularis*, or thread-worm. The canal may also be the seat of certain rare forms of developed parasites, and of cysts containing larvæ of a parasitic nature.

Parasites are always introduced into the canal from without, with foods or drinks. The round-worm and the thread-worm are most frequently present in young persons, the tape-worm in adults. The worms are a source of great irritation so long as they remain, and in childhood are one of the common causes of convulsion from reflex irritation.

Diarrhœa.

The word diarrhœa is used to express a looseness or discharge from the canal, in which the action of the bowels is much disturbed, and the contents eliminated are fluid and profuse. It may be regarded rather as a symptom of disease than as an actual primary disease; but custom has made it to be considered as a disease of itself. Diarrhœa is classified, ordinarily, under the following heads.

Simple Diarrhœa.—A temporary loss or discharge from the bowels of fluid secretion without acute pain. This is called chronic catarrh of the bowels when it is long-continued. Diarrhœa is often dependent upon cold, and on changes of season; it is due to congestion of the mucous surface of the intestinal canal, a tendency which in some persons is constitutional.

Irritative Diarrhœa.—Diarrhœa accompanied with griping and pain, in which the discharge is induced by some foreign substance in the canal, creating the irritation and exciting the over-secretion.

Choleraic Diarrhœa.—A condition of disease in which the discharge of fluid from the bowels is very profuse, with pain, exhaustion, coldness of the body, and, it may be, cramps in the limbs. This form of diarrhœa is the same as the cholera of the autumn season, generally described and known as autumnal cholera. It is apt to assume an epidemic form, but it is not contagious.

Paralysis of the Intestines.—The intestines in various parts of their course are subject to paralysis, or palsy, either from muscular wasting or from want of nervous supply. The condition is dependent on some disease pre-existent in the muscular fibre, or in the nervous centres, or in the nerves of the motor parts of the cerebro-spinal system. It is attended with deficiency of propulsive power in the canal, and, as a result, with imperfect action of the bowels.

Colic.

An acute spasmodic affection of the intestinal canal, without diarrhœa, but often attended with severe cramps of the abdominal muscles, extending even to the muscles of the extremities. There may be some fever with colic, but severe cases occur in which there is no febrile excitement at all.

There are two varieties of colic.

Idiopathic Colic.—Colic in which the disease occurs from ordinary causes; usually, from accumulation in the intestines of indigestible and irritating food.

Lead Colic.—Colic in which the disease is caused by taking into the body some preparation of lead, which in its poisonous action specially affects the muscular coats of the intestinal tube. Potters, who dip the earthen-ware in a solution of lead; painters, who work in lead paint; and plumbers, who handle white lead, are very liable to this form of colic, and are sometimes fatally affected by it.

Constipation.

Constipation is a condition of disease in which the intestinal canal is inactive, and in which, as a result, it becomes loaded with undigested parts or *débris* of digested food. The large intestine, the colon, is the part usually inactive and loaded in constipation, the signs of the affection being pain and sense of weight in the abdomen, depression of spirits, biliousness, headache or dull pain in the head, ringing noises in the ears, and bad appetite. Constipation may be due to mechanical obstruction in the canal, or to paralysis. In the large majority of instances it is caused by want of exercise, indulgence in improper food, or inattention to the daily natural action of the bowels. It is more common in women than in men, and more in men who follow in-door and sedentary pursuits than in those who are engaged in active out-door occupations. It tends to recur more determinately in the aged of both sexes, and it seems to be an hereditary condition in some families.

Diseases of the Lower Bowel or Straight Intestine.

The last portion of the intestinal canal, a tube about ten inches long, extending from the end of the colon to the extreme outlet of the canal, and called the straight intestine or rectum, is subject to several forms of local disease.

Ulceration.—The mucous surface of this part of the intestinal tube is subject to ulceration as a result of inflammation, and, in exhausting diseases, this is attended with much irritation and discharge from the bowels, giving rise also to paroxysms of irritative fever. The ulcerative surface is usually limited and irregular.

Abscess.—A condition in which, subsequent to inflammation,

there is a circumscribed accumulation of matter or pus in lower part of the straight intestine.

Fistula. Fistula in Ano.

An opening commencing as a result of inflammation and of localized ulceration in the mucous surface of the intestine, low down in its course, perforating its coats and extending from the lower or straight bowel, into the surrounding cellular tissue, and downwards until it opens through the skin near to the natural outlet of the alimentary canal. Through this fistula the contents of the bowels are apt to pass, unchecked by the volition of the sufferer. This affection, which is called technically "fistula in ano," is a frequent complication of tubercular disease, and particularly of tubercular disease of the lungs, pulmonary consumption. It sometimes occurs from the accidental lodgement in the lower bowel of some foreign body, as a fish-bone or fruit-stone. Fistula is met with in persons of almost all periods of life, and, though painful, is usually amenable to surgical art. The fistulous opening is, in most instances, from the bowel to an outlet through the skin by the side of the intestine. It sometimes opens into the bladder,—*recto-vesical fistula*,—in other cases into the urethra,—*recto-urethral fistula*,—and in the female, in some instances, into the vagina,—*recto-vaginal fistula*. These forms of fistula are now also largely amenable to medical and surgical art.

Hemorrhoids.

Swellings, vulgarly called piles, in the lowest part of the straight intestine and consisting of a vascular enlargement, or of enlargements, covered by the mucous membrane, which protrude into the passage, and which often extrude from the outlet of the bowel so as to exist there as small or large painful external tumefactions. There are three varieties of hemorrhoids or piles.

Internal.—When the swelling does not descend so as to appear externally, but is a painful internal obstruction, occasionally giving out blood, internal piles are said to be present.

External.—When the enlarged tumefactions descend and are detectable externally, external piles are said to be present. They may or may not be returnable.

Bleeding.—When either internal or external piles give out blood they are called bleeding hemorrhoids or bleeding piles.

Hemorrhoids are caused by indifferent flow of blood through the hemorrhoidal veins, or veins which return the blood from the lower bowel into the circulation. These veins empty in great part into the hepatic portal, or venous portal system of the liver, and in almost every case the hemorrhoidal affection is due primarily to congestive and temporary inaction of the liver. For this reason the disease is common in persons who lead a sedentary life, and especially in those of sedentary life who indulge in alcoholic drinks. As a rule the first attack of piles is developed after constipation. The affection is often excessively painful, is attended with dejection of mind, and where there is much loss of blood, with exhaustion of body. It is amenable to medical and surgical art.

Hemorrhage. — Hemorrhage, or bleeding from the lower bowel, is usually caused by an enlargement and congestion of the hemorrhoidal veins, but it may also occur from ulceration. In all cases it is secondary to some other local affection.

Fissure.—An extremely painful affection, in which the lip or outlet of the lower bowel is fissured, the mucous membrane being divided or cleft transversely down to the circular fibres of the sphincter, or muscle which surrounds and closes the outlet. The fissure may be caused originally by tear or accidental cut from the passage of a sharp substance, like a fruit-stone or fish-bone passing from the bowel. It is more frequently the result of deep ulceration of the mucous membrane. It often attacks those who are subject to hemorrhoids, in whom the mucous membrane is easily congested. It is a remediable affection.

Prolapsus.—A state of local disease in which the intestinal tube, or its mucous membrane at the lowest part, is prolapsed or projected from the outlet of the bowels. The condition is most common in children, but may occur in persons of any time of life. The protrusion may be to the extent of three or four inches, and in the severest forms may be attended with complete strangulation of the extruded part. It is caused in most instances by constipation, and is generally a recoverable condition, but not always without operation.

Stricture of the Lower Bowel.

Internal constriction of the bowel, so that the passage is obstructed in part or altogether, is called stricture. There are several varieties of this affection.

Spasmodic Stricture.—Stricture arising from spasm of the muscular circular fibres, and due to irritation of a nervous centre. This is sometimes an hysterical phenomenon.

External Stricture.—Stricture produced by pressure on the tube externally, as by a tumor, an abscess, or a band.

Internal Non-malignant Stricture.—Stricture in which the mucous membrane is contracted from thickening or deposition beneath it; or from ulceration followed by contraction.

Malignant Stricture.—Stricture in which the constriction is caused by one or other of the varieties of cancer.

In most cases of stricture of the lower bowel the disease belongs to the cancerous or malignant form. It is more frequently developed in the lower third of the tube than in the other parts.

Tumors.—The lower bowel is the local seat of tumors which may be simple or malignant, and of the same types as those already described as developing in other parts of the intestinal canal.

Parasitic Disease.—The lower bowel is the most common seat of the parasite called thread-worm, *Oxyuris vermicularis.* It may also be the seat of cystic parasitic growths.

Spasm of the Sphincter.—The circular band of muscular fibres which encircle the lower bowel at its outlet is sometimes subject to spasm and spasmodic closure: this may be of four kinds.

Hysterical.—Spasm of the sphincter, developed as the result of hysterical spasmodic excitement.

Irritative.—Spasm of the sphincter, excited by irritation in the bowel above, or in some remote nervous surface or centre.

Traumatic.—Spasm of the sphincter, the result of some injury inflicted from without.

General.—Spasm of the sphincter occurring as a part of a general spasmodic condition, as in tetanus.

Tenesmus.—A painful condition of the lower part of the lower bowel, accompanied with straining, desire for action of the bowel, spasm of the sphincter, sense of acidity in the throat by which the teeth are "set on edge," and general irritation, with some irritative fever. The affection is usually due to irritation within the intestinal canal from the presence of a foreign substance.

Neuralgia.—Painful neuralgic seizure, affecting the lower bowel, and occurring, as a rule, with more or less of periodic

regularity. It is connected usually with some other form of neuralgic pain, and especially with sciatica.

Pruritis.—An affection of the lower bowel at its outlet, consisting of an intolerable itching, and attended often by a slightly raised eruption, which may extend to the adjoining skin. It is caused most frequently by congestion of the vessels of the mucous membrane from disturbance of the action of the liver, and is accompanied usually by constipation and other signs of dyspepsia.

Injuries.—The lower bowel is, lastly, subject to local disease from external wounds and from impaction of foreign bodies within it.

Diseases of the Peritoneum.

Peritonitis.

The peritoneum, or delicate investing serous membrane of the intestines and abdominal cavity, is subject to various local conditions of disease.

Inflammation of the peritoneal membrane is called peritonitis. It is an inflammatory condition of extreme danger, and is usually attended with high febrile excitement and acute pain. There are many forms of this inflammation.

Idiopathic Peritonitis.—In this form the membrane is primarily affected, the disease coming on from cold and chill, or from exposure to excessive fatigue.

Puerperal Peritonitis.—Metro-Peritonitis—Inflammation of the membrane occurring in women during or after childbirth, and often a part of puerperal fever.

Suppurative Peritonitis.—Peritonitis with the formation of matter or pus within the peritoneal cavity. A form of the disease which is extremely fatal owing to the intensity of the local changes and the secondary absorption of purulent fluid from the peritoneum into the blood.

Chronic Peritonitis.—Peritonitis continuing in a subdued form for a long time, and maintaining an intermittent febrile state of the system.

Tubercular Peritonitis.—Inflammation of the peritoneal membrane induced by deposit of tubercular matter upon or near to the membrane. The disease often assumes an acute form, with much fever. It is very fatal.

Adhesive Peritonitis.—A condition in which the surfaces of the inflamed membrane ultimately adhere by exuded adhesive material, at different points, so that the intestines become agglutinated or bound together by the adhesions.

Dropsy of the Peritoneum. Ascites.

A condition of the peritoneum in which the membranous cavity contains an excess of serous fluid. This disease, commonly called abdominal dropsy, is, as a rule, dependent on some other organic mischief by which obstruction to the return of venous blood to the heart has been produced. It is a very common result of liver disease and of organic affections of the heart.

Tumors of the Peritoneum.

The peritoneal membrane may afford attachment to morbid growths non-malignant; cancerous, and malignant colloid,—gelatinous. It may likewise be a seat for attachment of cysts containing parasitic developments.

Injuries to the Peritoneum.

The peritoneum is very liable to injuries of various kinds. It suffers easily from contusions of the abdomen; from wounds; from pressure and irritation caused by foreign substances in the intestines; and from pressure of the intestines themselves when they are forced into the openings from the abdomen, as in hernias. The serious results of all such accidents led the older physicians to entertain an almost superstitious dread of injury to the peritoneum, and although they greatly overrated the danger in many ways, their anxiety, drawn from their experience, was not without a considerable quality of sound learning and judgment.

CHAPTER III.

DISEASES OF THE HEART, CIRCULATORY APPARATUS, AND BLOOD.

THE local diseases of the heart and circulatory apparatus are placed under various heads, according to the particular part that is affected. The parts include the pericardium, or double fibro-serous bag in which the heart is enveloped, and by which it is retained in position, separated from the lungs, and lubricated. The endocardium, or inner lining membrane of the heart. The structure of the heart itself. The coronary or special circulatory apparatus of the heart.

DISEASES OF THE PERICARDIUM.

The pericardium is subject to several varieties of disease.

Pericarditis.

There are two varieties of pericarditis.

Simple pericarditis.—Inflammation of the pericardial membrane.

Suppurative pericarditis.—Inflammation with formation of pus or matter.

Adhesion.

Adhesions in whole or in part of the outer layer of the pericardium to the inner layer which is always adherent to the heart. These adhesions follow inflammation of the membrane, and are most serious impediments to natural motion of the heart after they have occurred. With them are sometimes connected deposits of bony or calcareous substance, which cause the heart to be more or less encased in unyielding structure.

Dropsy of the Pericardium.

An accumulation of watery or serous fluid in the pericardial sac or bag, called vulgarly dropsy of the heart, resulting sometimes from inflammation of the membranes, and sometimes from other causes, such as general dropsy. Dropsy of the pericardium has also been known to occur as a purely local disease, without any definite signs of pre-existent disease, and has proved suddenly fatal by the fluid compression exerted upon the heart. To this and all other affections of the pericardium those who are of rheumatic constitution are most liable. Pericardial diseases are amongst the most serious complications of rheumatic fever and the rheumatic constitution.

Diseases of the Endocardium and Valves of the Heart.

Endocarditis.

Inflammation of the endocardium, or inner lining membrane of the heart, occurring on one or both sides of the heart, but most frequently in the ventricle on the left side.

Valvular Disease.

Diseases of the valves of the heart take two varieties of name, one having reference to the name of the valves affected, the other to the nature of the disease.

In relation to the valves themselves there are said to be four varieties of disease, viz.:

Aortic disease.—Disease of the semilunar or aortic valves; the valves which lie between the aorta, or great out-going artery, and the left ventricle, or great out-forcing structure of the heart.

Mitral disease.—Disease of the large bicuspid or mitral valve; the valve which lies between the left auricle and left ventricle of the heart.

Pulmonic valvular disease.—Disease of the small semilunar or pulmonic valves; the valves which lie between the pulmonary artery,—the artery proceeding to the lungs from the right ventricle of the heart,—and the right ventricle.

Tricuspid disease.—Disease of the tricuspid valve; the valve which lies between the right auricle and the right ventricle of the heart.

Of these valvular structures the valves on the left side of the heart,—the aortic and mitral,—are much more liable to disease than are the valves,—pulmonic and tricuspid,—of the right side. It may be said that valvular disease of the right side is comparatively rare, a fact I have endeavored to explain in my experimental researches on "the synthesis of valvular disease," by showing that in most instances the valvular disease is due to irritation caused by blood that has undergone an unnatural chemical change while passing over the lungs from the right to the left side of the heart. Valvular diseases are by far the most prevalent in persons of rheumatic constitution, and are the frequent consequences of acute rheumatic fever.

Divided according to the character of the disease the valvular affections of the heart are:—

Vegetations.—In which small growths, resembling fungoid vegetations, occur on the margins or fine surfaces of the valves.

Thickening.—In which the fibrous tissue of the valvular structure is thickened and condensed, so that the valves do not act with due facility in opening and closing, for the admission or arrest of the blood current.

Fatty and calcareous degenerations.—The fatty degeneration is called atheroma, the calcareous is called ossification. They consist of changes in which the valvular structures are transformed, in part, into a form of fatty structure, or into bony substance, and in which the regulating movements of the valves is extremely impeded.

Aneurism.—Disease consisting of enlargement,—dilatation,—of the valves, or of enlargement of the vessels by which the valves are supplied with blood.

Laceration.—Accidental tear of the valvular structure, under great excitement or strain. In very rare instances this accident has occurred where there has been a fairly healthy condition of valve.

Dilatation of the orifice of the valves.—A condition in which the opening or orifice of the valves is much dilated, so that the curtains of the valves which spring from the orifice become incapable of meeting perfectly in the act of closure. This condition is common in instances in which the heart is subjected for many years to severe strain from over-action, and where all its structures are dilated. It is singularly common in persons who drink freely of alcoholic liquors, few of whom, indeed, escape it.

In certain of these forms of valvular disease *regurgitation* of blood is not unfrequently detected by the physician. The term means that owing to the imperfect action of the valves they do not close efficiently, so that the blood which they ought to prevent from returning, and which they ought to direct in its course, flows back or regurgitates into the cavity from which it was projected. Regurgitation through the aortic valves is the most frequent form of this derangement.

Organic Diseases of the Structure of the Heart.

The heart, an organ composed of muscular fibre, is subject to diseases of its own true structure, and to diseases arising from nervous or functional disorder. The first of these are the *organic* diseases of the heart, and they range as follow:

Myocarditis.

Inflammation of the muscular structure of the heart. A rare form of disease, ending often in fibrous or fatty degeneration of the muscular structure. There are three varieties.

Interstitial, occurring during existence of the syphilitic taint or constitution.

Rheumatic, occurring in persons of rheumatic constitution.

Alcoholic, occurring in persons addicted to the free use of alcoholic drinks, and ending often in fatty degeneration.

Abscess of the Heart.

Formation of matter or pus in the muscular structure of the heart. A very rare affection.

Hypertrophy of the Heart.

Hypertrophy is a condition in which the heart is increased in size beyond what is natural, until, instead of weighing nine or ten ounces, it increases to double, or, as I once saw it, to three times that weight. There are three varieties of the disease.

Hypertrophy simple and general.—In which the whole of the muscular walls of the heart are enlarged equally, the cavities of the organ remaining of the same size.

Hypertrophy simple and partial.—In which a part of the wall of the heart, usually of the left ventricle, which is naturally twice

as thick as the right, is increased in size, the cavity or ventricle remaining of the same size as in health.

Hypertrophy general, with dilatation.—In which the walls of the heart are generally increased in size, the cavities being also dilated or extended beyond their natural capacity.

Hypertrophy partial, with dilatation.—In which one of the sides of the heart, usually the left, is enlarged, with dilatation of the corresponding ventricle or cavity.

Hypertrophy in its purest forms means simple increase of the muscular structure of the heart; but it is rarely long unattended with other changes, such as fatty deposit. It creates extreme embarrassment to the circulation of the blood. It is induced by various causes. (*a*) By obstruction to the circulation, and over-work of the heart in order for it to overcome the difficulty; (*b*) by excessive and long-continued physical exertion, as practised by runners, rowers, and persistent sharp walkers such as postmen; (*c*) and above all, by constant stimulation and over-action from the use of alcoholic drinks. Hypertrophy with dilatation is a frequent combination of disease.

By some the affections of the heart are divided, according to the parts implicated, whether on the left or on the right side of the heart. They are so divided in the College record.

Atrophy of the Heart.

Atrophy, as its name implies, is wasting of the substance of the heart, so that the organ becomes reduced in size. The waste occurs in the muscular structure, and, as a rule, to which however I have more than once seen an exception, is general in character, including the whole structure. The cavities of the heart usually retain their natural capacity, or they may be increased in capacity rather than diminished. Atrophy occurs during wasting condition of the body, and is commonly attended by structural change or degeneration. I have seen it caused by excessive development of fat around the heart, and I believe this to be a more important cause of it than has been supposed up to the present time.

Excess of Fat on the Heart.

In animals fatted for the market it is found that the heart is loaded with fat, which lies in a dense layer close to the muscular structure, and which in the sulci or spaces between the auricles

and ventricles, and between the ventricles on the exterior of the heart, exists as a thick roundish layer that cannot easily be torn away. In some instances, in the human family, in persons subject to obesity, fat in like manner accumulates on the heart, and forms a firm, heavy, and cumbersome surrounding. The effect is to interfere seriously with the action of the heart, to create heart-breathlessness,—cardiac apnœa,—on slight exertion of the body, and ultimately to derange the nutrition and structure of the heart itself.

Dilatation of the Heart.

Dilatation of the heart is a condition in which one or more cavities of the heart are dilated without either hypertrophy or atrophy of the muscular walls; or in which the orifices leading into or out of the cavities of the organ are expanded, dilated, and relaxed. There are two varieties. (*a*) Of the left side or cavities of the heart, auricle, ventricle, or both. (*b*) Of the right side, auricle, ventricle, or both.

Fatty Degeneration of the Heart.

Fatty degeneration of the heart is a change of the physical structure of the organ in which the true muscular elements which lie in transverse lines on each other in each muscular fibril, are transformed into or replaced by series of fatty particles which possess no power of contractile aggregation, and undergo no modification into motion under nervous or other stimulus. The heart so degenerated is therefore, in proportion to the extent of the change, practically dead. Fatty degeneration is promoted by indolence and luxurious living; by living in bad air; and, most easily of all, by the use of alcoholic drinks. It becomes an hereditary disease.

Fibroid Degeneration of the Heart.

A degeneration of the muscular structure, of slower development and course than the fatty change, in which muscular elements are replaced, more or less, by fibrous elementary structure which possesses no irritability, and fails to respond to the nervous stimulus. Together with this state of disorganization there is thrown out a plastic fluid, probably a modified fibrine, which is not developed into natural muscular tissue, but which fills up the

meshes of the fibrous structure, causing a deposit which enlarges, hardens, and incapacitates any remaining muscular fibres for their natural action. Fibroid degeneration is connected often, if not always, with some constitutional taint, syphilitic, rheumatic, or alcoholic. It is less rapidly fatal than the fatty degenerative change.

Aneurism of the Heart.

Aneurism of the heart means a condition in which, owing to weakness of the muscular wall, there is a protrusion of the wall pushing before it the serous covering of the heart, and forming a pouch or sac containing blood. The disease is very rare, and when it occurs is preceded by degenerative changes.

Acute Aneurism of the Heart.

Another form of aneurism defined by the Royal College as applicable to cases "in which blood becomes effused into the substance of the heart owing to inflammatory softening and rupture of the endocardium and muscular tissue."

Rupture of the Heart.

An accident in which the heart under strain bursts, or is ruptured in some part, letting out its contained blood into its pericardial sac or cavity. Philip V. of Spain is said to have died from rupture of the heart on hearing of the defeat of his army. Some deaths are occasionally recorded from the same cause in our own time, after excitement from hurry, rage, or other form of severe excitement. In such examples there has always been some preceding disease of the structure of the heart, such as fatty, fibroid, or aneurismal degeneration. The accident is rare. I once knew rupture of the heart to occur in a man who was supposed to have died of Asiatic cholera.

Disease of the Coronary Arteries.

The arteries which go off first from the line of the circulation to supply the prime organ of the circulation, the heart itself, with blood, are called the coronary arteries, because they encircle the heart, as it were, with a corona or crown. These arteries are subject to various forms of disease.

Dilatation.—General dilatation of the vessel.

Obstruction.—From narrowing of the vessels or deposit in them.

Degeneration.—From fatty or osseous changes of structure.

Aneurism.—From aneurismal enlargement of the artery.

Disease of the coronary arteries leads invariably to injury of the nutrition of the heart itself, and to degenerative changes in its structure.

Sudden death sometimes, but very rarely, occurs from quick arrest of the circulation of blood in the coronary circulation.

Cyanosis, or Blue Skin Disease.

The heart is subject to various kinds of malformation, that is to say, in plain language, departure from the natural construction. The error of this kind which concerns us most is that which gives rise, after birth, to the disease cyanosis, so called because the body of the sufferer is blue in tint. The error in the mechanism of the heart in this disease is, that an opening between the right and left auricles of the heart, called the foramen ovale, and which previous to birth allowed the blood in the right auricle to flow direct into the left auricle without passing first through the lungs, but which ought to close after birth by a firm membrane so as to prevent that direct exit and insure that the blood is made to pass over the lungs, does not close. The result of the failure of closure is that after birth venous blood passes from the right to the left side of the heart without undergoing due change from respiration, *i.e.*, without being duly arterialized. The person who has cyanosis is of dark bluish color; is cold over the body; is of feeble constitution; and, rarely lives beyond five years, although I have known an instance of the kind in which, under extreme care, life was extended to twenty-two years. The intellect, in this form of disease, if not brilliant, may be clear and sound. Death is usually caused by congestion of the lungs, or by development of tuberculous or other disease of the breathing organs.

In one instance recorded, by the late Dr. Mayne of Dublin, the deficiency of the heart above named, deficiency of closure of the foramen ovale, led to an opposite condition, namely, to the passage of a portion of arterialized blood from the left auricle back into the right auricle, and into the venous side of the circulation; so that the person affected, a woman, who lived to be over twenty years old, was always being supplied with *super-*

oxygenated blood. She was the subject of profuse perspirations, attended with great lassitude and feebleness of body, like a feeble person in a tropical climate. She died suddenly after some slight exertion.

Functional Diseases of the Heart.

Syncope.—Fainting Fit.

A failure of the heart, leading to sudden collapse, coldness and failure of the body, with unconsciousness, called commonly deliquium, swoon, or faint. Syncope may occur from nervous shock, bodily exhaustion, loss of blood, or mental emotion. In syncope, as I have shown in a Croonian Lecture, the size of the heart is for the time reduced, and the organ, which still continues to beat regularly, is working at low pressure, in a state of "passive efficiency," that is to say, in a degree sufficient to sustain its own life, but not to maintain consciousness and the other active functions of vitality.

Spasm of the Heart. Angina Pectoris.

A sudden spasm of the chest, involving the heart, attended with severe pain, coldness of the body, and prostration, and with much difficulty of breathing. The disease occurs in paroxysms, and is vulgarly called heart or breast pang. I have proposed to call it cardiac apnœa, heart breathlessness.

Irregularity of the Action of the Heart.

Under the influence of organic disease of the organ, but much more frequently under nervous disturbance, the heart may undergo irregularity of movements. There are several varieties of these irregular movements.

Palpitation.—Palpitation is a sudden violent over-action of the heart, during which the natural sounds are indistinguishable, and the impulse is so strong that it may even be seen through the clothes of the affected person. The pulse, in this state, is extremely rapid in movement, and when its movements are translated into sound by the sphygmophone, instead of being heard as three distinct sounds, the sound is as of a wheel in loud and rapid rotatory motion. Palpitation is usually attended with flushing of the face, sense of fulness and oppression of the chest, rushing of

blood to the head, and want of power, ending in faintness or exhaustion. It is usually excited by some distant irritation, in the stomach, bowels, or throat, and is often relieved immediately by eructation of flatus.

Acute irregularity of the heart-beat.—An irregularity in which each beat of the heart is given in correct order of succession, the one stroke to the other, but in series of five, ten, or other number of beats, differing in rate from other series. This irregularity occurs when the action of the heart is feeble, as in anæmia, and after loss of blood.

Prolonged irregularity of the heart-beat.—A condition in which the strokes of the heart may register during one minute a certain number of beats, say seventy, and the next minute a different number, say ninety or a hundred, so that from minute to minute the rate of motion varies. This irregularity is common when there is disease of the brain, and in some acute affections of the brain in children it is a very dangerous indication.

Intermittent Action of the Heart.

Intermittent action of the heart is a condition in which the stroke of the heart is every now and then lost, so that when listening for the sound of the stroke in the chest over the heart, or when feeling for it in the pulse at the wrist, it is lost, and does not occur when it is expected and ought to occur. If we are listening to the healthy heart we hear always two distinct sounds, a first sound and a second sound, the second sound being followed by a pause. The first sound, which is connected with the act of contraction of the ventricles and with the sending forth of the blood over the lungs and over the whole body, the systole,—*sustellō*, I contract,—is called technically the systolic sound. It is caused by the closure and tension of the great valves lying between the auricles and ventricles of the heart, and resembles in sound the word *lub*. The second sound is connected with the time of the refilling of the heart with blood, when the ventricles are in a state of dilatation, *diastole*,—*dia*, apart, *stellō*, I send, and is called, technically, the diastolic sound. It is caused by the closure and tension of the little semilunar valves which lie at the base of the pulmonary artery and great aorta, and resembles in sound the word *dûp*.

So there are produced two very distinct sounds, *lub*, *dûp*, and

then follows a *pause*. The first sound, *lub*, is equal in length to the *dûp* and the *pause*, the whole occurring within a second of time. With the *lub* the heart is contracting; with the *dûp* it is refilling; with the pause it is resting, waiting, as it were, to take breath before it sends forth its charge. That little pause is, in fact, the holiday time or sleeping time of the heart; the only rest the organ has in the three billion of strokes which it must make in a life of fourscore years; but after all, when it is fairly obtained, one-fourth of the whole period, viz., twenty years of rest. In intermittent pulse this rhythm of work is lost. When we listen for the *lub*, *dûp*, *pause*, we get it a few times, and then, with a lapse which may almost make the listener start, we miss the long stroke, and get instead, *dûp;* afterwards in a sort of knuckling over fashion, there follows *lub*, *dûp*, *dûp;* and, next time, in rhythm again, *lub*, *dûp*, *pause*. If the finger be on the wrist while the ear is over the heart, the pulse, at the moment when the ear loses the *lub*, fails to be felt; the systole or sending forth of blood has been, for that time, withheld.

Intermittent action of the heart means, therefore, a failure in the contraction of the heart, by which the blood is sent forth over the body. It does not, of necessity, mean any disease in the structure of the heart itself, for it may be present when the heart is in the most healthy state organically; but it means a functional disturbance owing to irregular supply of nervous stimulus.

My researches, recorded in another essay, have shown that intermittent pulse is usually the result of some form of nervous shock,—grief, anger, fear, physical injury, anxiety, and the like. It is almost always present, at times, in persons who have passed their sixtieth year, but it is often developed much earlier in life, and it may be congenital and be existent from the moment of birth. It is not of itself a fatal condition; but when the heart is diseased, or when other diseases are present in the body, it is a source of evil, adding much to the danger. It may be considered essentially as a sign of organic nervous failure.

Fibrinous Deposits in the Heart.

In some forms of disease the cavities of the heart become the centres of fibrinous separations or deposits of fibrine from the blood. In some inflammatory diseases, croup, inflammation of the lungs, malarial fever, surgical fever, or fever following surgi-

cal operations, puerperal fever or fever of childbed women, these depositions are causes of death, acting in a rapidly fatal manner. They are also met with after certain forms of disease from animal and mineral poisons. The separations of fibrine may occur in either of the cavities, the auricles, or ventricles, on the right or left sides of the heart, but the right cavities are their most frequent seats, and the right auricle the most frequent part in which the process of separation commences. The fibrinous masses formed in the heart are often of pure white color, fibrous in texture, and so extensive as to fill the cavity of the right auricle and pass through the ventricle into the pulmonary artery and its branches. The mass is sometimes a solid cylinder, at other times tubular, and now and then a spiral, from blood having flowed around it.

Diseases of the Arteries.

The larger blood-vessels, arteries, and veins are liable, like the heart itself, to various structural changes or diseases. Those of the arteries are classified in the following order.

Arteritis.

Inflammation of an arterial structure, beginning in the inner lining or serous coat of the vessel. It is a rare disease, and of difficult detection during life.

Fatty and Calcareous Arterial Degeneration.

Changes taking place in the structure of the arteries, leading to deposits of fatty or of calcareous material. The first of these changes is called atheroma, the second, ossification. In both instances the vessels at the affected part lose their elasticity and their contractile power, and are easily ruptured under extra pressure from the heart, or from back pressure due to retarded circulation in the veins. In this condition rupture of the arteries supplying the brain is a frequent cause of apoplexy ; and rupture of the large arteries near the heart is a frequent cause of sudden death, from internal hemorrhage. The degenerations are not common until after middle life.

Narrowing and Obliteration of the Arteries.

Conditions in which the arteries are reduced in calibre or completely closed. The closure is usually due to deposits within

the coats of the vessels, or to pre-existent inflammation of the vessels.

Occlusion of the Arteries.

The arteries are sometimes occluded, so that they fail to permit the blood coming from the heart to traverse them. Occlusion is of two kinds.

(*a*) From compression. In which an artery is subjected to compression from pressure exerted upon it by some external substance, such as a tumor or growth; or from the displacement of an organ; or from effusion of fluid into a closed cavity; or from the presence in the body, near to an artery, of some foreign substance which presses upon the artery.

(*b*) From impaction of coagula or clots within the artery. Occlusion of a portion of the arterial system is much more commonly caused by impaction, *i.e.*, by the filling up of a portion of an arterial tube with coagula or clot of blood. The clot in these cases may fill up the vessel at the spot where it, the clot, is formed, that is to say, at the place where the process of coagulation has occurred. Or a small clot may be formed in one part of the arterial system, or in the heart itself, and may be carried to another part where, owing to the calibre of the vessel being less, it fills up the vessel and creates the obstruction. This latter condition is one of the causes of apoplexy, a small clot set free fills up an arterial trunk; or a series of minute clots fill up the minuter branches of the arterial circuit of the brain. Occasionally these detached masses which occlude the arteries are composed of other matter than coagulum of blood. Portions of warty excrescences detached from the valves of the heart may cause the obstruction, and a mass composed of fatty substance has also been met with. The old physicians called the larger depositions of fibrine which occur in the arterial vessels, polypi, mistaking them for polypoid growths.

Dilatation of the Arteries.

Dilatation is an increase in the size of an artery beyond its natural calibre, but equally in the direction of its course. Dilatation is common in the large arteries near the heart in persons of advanced life, and is often attended with changes and deposits in the arterial coats. There is also a form of general dilatation

of the arterial system common in hard drinkers and others who have subjected the arterial vessels to great pressure of blood. The dilated artery is incapacitated, to a large extent, for the work it has to perform in the economy. It has lost its elasticity to a considerable degree, so that its recoil, from the dilating stroke of the heart, is imperfect. The circular organic muscular fibres with which it is endowed are, moreover, deprived of their natural due contractile power.

Aneurism of the Arteries.

An aneurism of an artery is a dilatation of the arterial vessel, but with this difference from simple dilatation, that the enlargement is not general in the course of the vessel, but is at one part, and is attended with thinning, or even rupture, at the affected spot of one or more of the arterial coats, which, as we have seen, consist of an investing, an elastic, and a muscular coat, and an inner or serous lining. Aneurisms are classed under several heads. The following are the most important varieties of aneurism.

(*a*) Fusiform aneurism. In which the dilated part is like a spindle, large in the middle and reduced at both ends.

(*b*) Vascular aneurism. In which the dilatation is round like a hollow ball or sac.

(*c*) Diffused arterial aneurism. In which the sac or surrounding wall is not made by the dilated artery itself, but by the condensed surrounding tissues, which have become united or adherent with the broken arterial coats.

(*d*) Dissecting arterial aneurism. In which there is partial tear or rupture of the internal tissues of the artery, and effusion of blood between the coats of the vessel, extending for some distance, and dissecting its way between the coats.

(*e*) Traumatic arterial aneurism. Aneurism in which the dilatation has been caused by a wound inflicted on the artery.

(*f*) Aneurism by anastomosis. Aneurism by arterial vessels which are carrying on a new circulation owing to obstruction in the main arterial current through which the blood originally passed.

There are some other varieties of aneurismal disease which are of rarer occurrence, such as arterio-venous aneurism, aneurismal varix, varicose aneurism, and arterial varix; but those

classified above concern us most as being the more decisive and frequent. Aneurism of the large vessels, as of the great aorta at its commencement or arch, and of the vessels springing from the arch, are the more serious and common aneurisms; but aneurism of the popliteal artery,—the artery running through the hollow space at the back of the lower limb between the thigh and the leg, behind the knee-joint,—is also common. Aneurism is induced by acts which cause great strain on the arterial system, and especially when such acts subject the body to rapid jerks and shocks. In the old posting days aneurisms of the aorta were so frequent, that the term "post-boy's disease" was applied to them.

Aneurisms are specially liable to occur in persons who are disposed to degenerative disease of the arterial coats, and it has recently been observed that persons who are born suffering from syphilitic taint, or who have themselves contracted that specific disease, are more liable to aneurism than other persons who are free of such constitutional affection. The question whether aneurism is hereditary in character has not been satisfactorily settled. It affects those who have approached the middle term of life more frequently than it does the young, but I have nevertheless seen it affecting the young, under fifteen years of age. An aneurism is occasionally healed, spontaneously, by deposits on its inner surface of fibrine from the blood and by gradual obliteration of its sac or pouch by that gradual process of deposition.

Rupture of an Artery.

Rupture of an artery means a breakage through the arterial coats, without preceding dilatation or aneurismal enlargement. Rupture occurs from two causes:—

(*a*) From disease in the artery itself by which the coats are weakened and destroyed.

(*b*) From disease of the structures outside the artery and extension of the disease into the vessel, as when an artery is involved in an abscess or in an ulceration.

Diseases of the Veins.

The veins, vessels which bring the blood back to the heart after it has passed from the arteries through the minute circulation, are subject to local changes or diseases, which, on the official collegiate record, are put under seven principal heads.

Phlebitis.

Inflammation of the structure of the veins. There are two varieties.

(*a*) Adhesive inflammation. In which the vein is inflamed, and has deposited in it fibrinous coagula or blood clot.

(*b*) Suppurative inflammation. In which purulent matter, pus, is formed at the part inflamed, often with ulceration of the vein, ending in adhesion and obliteration.

Phlegmasia Dolens. White Swelling.

A condition of inflammation of the iliac and femoral veins, veins of the groin and thigh, in which those vessels become obstructed by coagula, and the returning blood, from the lower part of the limb to the heart, is impeded or prevented. The limb thereupon becomes swollen, tense, white, and extremely painful, while the whole system becomes feverish, disturbed and prostrated. Phlegmasia dolens occurs in women after childbirth, and is rarely developed under other circumstances. It is sometimes rapidly fatal, the cause of it being often due to a detachment of a portion of the coagulated fibrine in the vein and the floating of the clot, thus separated, into the heart, where it becomes the centre of a larger clot and an obstruction to the blood in its passage to the lungs from the right side of the heart.

Fibrinous Concretions in the Veins.

Separations of fibrine from the blood in the veins; sometimes occurring from local causes, sometimes from a general condition of the blood in which there is a disposition to the separation and the coagulation of its fibrinous part.

Obstruction in the Veins.

Obstruction to the course of the blood back to the heart by a vein. There are two causes of such obstruction.

(*a*) External compression. In which the vein is compressed by external pressure, as from a tight garter or bandage; or from the growth of a tumor; or from pressure of fluid contained in a serous cavity or cyst.

(*b*) Disease in the vessel itself, by which its canal is filled, or its coats become adherent.

Phlebolites.

Small loose masses or concretions, feeling like seeds, in the veins. When they are in the veins immediately beneath the skin they can sometimes be moved by the pressure of the finger.

Varicose Veins.

Veins enlarged and knotted, the enlarged parts being filled with blood; a condition most frequently met with in the veins of the legs. The affected vein, in these instances, is distended with blood, and the distention may even proceed, though such is rarely the case, to actual rupture or tear. Varicose veins are induced in some persons by remaining long in the upright position and taking little exercise. They are also caused by obstruction to the return of the venous blood to the heart, from liver diseases and heart diseases, in which the free current of returning blood is impeded. The tendency to varicose veins is hereditary.

Nœvus Vascularis.

A vascular growth, on the skin, usually consisting of a series of small capillary vessels forming a dark vascular tumor, which in some cases throbs or pulsates. A small nævus is often vulgarly called a blood wart. A large diffuse nævus, not raised above the skin, is called a mother's mark or a port-wine stain.

Injuries of Veins.

The veins are often subject to injuries from blows, from compressions, and from wounds. They may be ruptured or torn without an external wound, and may give up much blood beneath the injured surface. This happens in cases of bad bruise. In some accidents a large vein having been cut or opened, air is drawn into the opening and, being carried to the heart along the vein, is a cause of fatal obstruction to the circulation of the blood through the lungs.

Functional or Organic Diseases of the Intermediate or Minute Vascular System.

Between the arteries and the veins there exists the wide-spread surface or net-work of communicating blood-vessels, which we already know as the minute circulation. To these vessels the

term capillary, *capillus*, hair, was once applied. The term still retains its place; but we are accustomed now, in speaking of the system of fine vessels which lie between the arteries and the veins, to think of them as something more than fine hair-like tubes for conveying blood. We know now that these tubes are endowed, in a part of their course, with contractile powers, and that their contraction is regulated with natural automatic precision by the nervous stimulus derived chiefly from the great centres of the organic or sympathetic nervous system, and that through the nervous system they are influenced both by physical and emotional vibrations. Hence this minute circulatory system is a centre of balance lying between supply and demand,—supply of blood for feeding and sustaining the tissues of the body, and demand, by the tissues, for the supply. Hence again, this minute circulatory system, subject to nervous disturbance from physical and emotional shocks, derived from without the body as well as from within, is exposed to variations of action and to changes which by their mere occurrence affect in the most sensitive and explicit manner the nutrition and the powers of the body.

A shock of a physical kind, a blow or stun, communicates to the minute circulation, through the nervous centres, an impulse which, for a time, more or less prolonged in proportion to the force of the impression, makes the small vessels dilate or contract, and so causes them to disturb the supply of blood which gives color and life to all the parts for which it is destined. In like manner mental shock communicated to this circulation, through the senses and nervous centres, causes dilatation or contraction, making the surfaces of the body, as the face, flushed or blanched, the mental concussion acting, virtually, as if it were a physical blow. In other states this minute circulation is relaxed or paralyzed, from different nervous impressions, and the course of blood through it being then uncontrolled, the vessels become distended with blood, the heart vehement in its action, and the secreting and nutritive processes quickened to overflow and waste.

The body "braced up" by exercise in an invigorating air is in a condition in which the healthy tension of the minute circulation is perfect. The body relaxed, inactive, in heated, unchanged, damp, tropical air, is in a condition in which its powers are greatly thrown away and its vital energies too much expended in

the mere acts of eliminating and evaporating the excessive products of uncontrolled secretion and nutrition.

We are beginning now to discern that much of the nature of diseased action is primarily traceable to influences telling upon the nervous supply of this great though minute system of blood-vessels, in which animal heat is generated, animal parts selected out, animal structures built up; in which, in short, all the animal organism is being constructed during life.

The minute circulation is subject to the following changes.

Spasm, or Contraction, more or less Permanent.

This may be produced by :—

(*a*) Physical shocks. Blows; stuns; heat-stroke; electrical stroke; nervous concussion; sudden exposure to great and dry heat; high barometric condition of air.

(*b*) Mental shocks. Passion; fear; sudden starts; sudden and intense grief.

(*c*) Substances taken into the body. Some poisons, such as strychnine, brucia, tobacco.

(*d*) Some conditions of disease. Acute fever; tetanus; tetanoid fever; various obscure changes in the nervous centres; pressure on organic nervous centres from flatulency and dyspepsia.

Relaxation or Paralysis of Minute Circulation.

This may be produced by :—

(*a*) Physical depressions, such as long-continued exposure to cold, or cold and wet; privation; impure air; low barometric condition of air; excessive fatigue.

(*b*) Mental depressions, such as long-continued grief; worry; anxiety; mental strain; prolonged as opposed to sudden fear; minor developments of all the passions; corroding excitements.

(*c*) Some diseased conditions. Such as exhausting diseases, like consumption and diabetes; organic changes in the nervous centres; possibly, some poisons of disease, such as cholera poison, and poison of scarlet fever.

(*d*) Some poisonous agents, such as alcohol, which for frequency of effect stands first; and agents like nitrite of amyl, which for suddenness of action on the minute circulation, in paralyzing it, is the most potent.

Organic Changes of Minute Circulation.

That changes of the most important kind for the production of disease are induced by long-continued or repeated disturbance in the minute circulation is a fact which day by day is being more and more recognized by the physician. In particular, it is now known that the organic modifications of structure in vital organs which follow persistent indulgence in alcoholic drinks are primarily due to the continuous relaxing influence exerted by those drinks on the nervous function of the minute vessels, and thereby on the nutrition of the structures which they supply with daily food in the form of blood. This is one, and at present one of the best illustrations; but the whole question of the origin of organic diseases is so intimately connected with the changes incident to the minute circulation, and is now being so carefully considered, that much wider views and departures of knowledge in relation to it may be expected during succeeding years.

It has been sufficient for my purpose in this place to give a mere glance, short, but I hope to the thoughtful reader significant, of the automatic mechanism of the nutritive processes in the living body; of the nervous action that is constantly at work to control that mechanism; of the agencies, physical, mental, moral, by which the control or rhythm may be modified; and of the results, immediate or deferred, which may follow upon such modification. In the course of the after parts of this volume, as in what has preceded, the bearings of the study of this automatic regulation and of the perturbations to which it is subjected, will be incidentally but amply represented in still more varied lights.

THE BLOOD IN RELATION TO DISEASE.

In the whole of the present chapter we have been treating of a system of vessels and tubes constructed for the purpose of conveying blood through the various parts of the body. It remains for me to add a few sentences on the blood itself in relation to disease,—the local diseases, as they might be called, of the blood.

The authorities of the Royal College in their nomenclature let this subject pass, as they do that included under our last heading, without notice.

To those who are not practically learned in medicine such an omission as this must seem strange. "The blood is the life,"

"blood disease," "good blood," "bad blood," "pure blood," "impure blood," "poisoned blood:" these and many other similar terms convey the idea that the blood is a very centre of all the diseases of mankind.

But when we come to precise facts, when we condescend to learn the true and fixed local diseases concentrated in the blood, great difficulties at once appear; because, after all, the blood, a constantly regenerated fluid, is but the channel through which diseased conditions, lying apart from itself, are temporarily presented. The blood may be the means of conducting or conveying into the tissues agents which may be poisonous, and so it may be itself poisoned from without. The blood may be the means, and is the means, of conveying poisonous products out of the body and of presenting them for oxidation and destruction to air, and so it may be poisoned from within. Both, however, of these states are but passing phases, and the same holds good in respect to all other conditions of disease, with a few exceptions to the contrary so rare they may be allowed to pass without special notice. The blood, in brief, is the whole body in transitory solution, and is the representation of the body in that state.

It is difficult, consequently, to name any permanent local diseases of the blood; but it is not without service to look at some changes in its constituent parts, which may be called its local temporary disorders or diseases.

Increase of Water of Blood.

The blood contains naturally 790 parts per 1,000 of water, and its specific gravity is 1.055. In some forms of disease, such as dropsy, the quantity of water may be largely increased. The blood of a woman who was suffering from ovarian dropsy, I found to have a specific gravity of not more than 1.016. Such blood is incapable of sustaining the natural functions of life.

Decrease of Water of Blood.

In certain exhausting diseases, such as cholera, where mere is a constant drain of watery fluid from the body, the blood may be left so dense from loss of its water that it may cease to be able to flow through the minute vessels.

Increase of Fibrine in the Blood.—Hyperinosis.

The blood naturally contains from two to three parts in the thousand of the plastic coagulable colloid called fibrine, which while circulating in the vessels is in the fluid state, but which, when the blood flows out of the body, sets or clots. In some conditions of the body the fibrine undergoes increase in the blood, especially in various forms of local inflammations, such as pneumonia, or inflammation of the lungs, croup, and malarial fever. In extreme instances it may increase to the extent of nine parts in the thousand. When an increase of the fibrine of the blood is present the tendency is to its deposition and to the formation of those fibrinous concretions which the ancient physicians called polypi, and which we have seen classified amongst the local diseases of the heart and blood-vessels.

Decrease of Fibrine in the Blood.—Hypinosis.

In some conditions the fibrine is decreased to one or even a lesser part in the thousand parts of blood. Blood so circumstanced is often uncoagulable; it easily flows out of the vessels, and if a small wound be made, a wound from the bite of a leech, for example, the bleeding may continue to a fatal issue. This state of fluid blood may give rise to an eruption on the body of dark spots like bruises, and to one form of the disease known as purpura. Children are sometimes born with the blood in this state of extreme fluidity, and in exceptional instances the affection is hereditary.

Decrease of Red Corpuscles of Blood.

The natural blood contains one hundred and twenty-seven parts in the thousand of corpuscular matter, made up in great part of the little circular red disks containing a substance known as *hæmaglobin*, in a thousand parts of which there is four and one-fifth of the metal iron. The corpuscles may be greatly reduced in amount without actual danger to life; but the reduction of them gives rise to paleness of the blood, and, as they are the bearers of the oxygen of the external air into the body, such reduction gives rise also to paleness and feebleness of the body, and to defective nutrition. The disease "anæmia" is due to a reduction of red corpuscles in the blood, and the "anæmic state,"

from the same cause, is present in many lingering and wasting diseases. The term "*poor blood*" is commonly used to indicate this state.

Injury and Destruction of Red Blood Corpuscles.

The red corpuscles of the blood are subject to injury, and even to destruction, by various agents acting on the body. By admixture of ammonia and of other alkalies with the circulating blood the corpuscles can be wholly or partly dissolved, made crenate at their margins, and irregular as if indented or notched. By the smoke of tobacco they are modified in a similar form. By alcohol taken freely into the body they are reduced in size, and lose their true rounded form, becoming long and "truncated." In blood surcharged with soluble saline substances they are reduced in size, shrunken. In blood surcharged with water they are increased in size, lose their flattened form and depressed centres, and become of rounded or globular shape. In instances in which the blood is surcharged with carbonic acid, the corpuscles lose their red color, and the mass of the arterial as well as of the venous blood becomes dark in color.

Under all these varying states, the natural function of the blood corpuscle, its power to condense the oxygen of the air which it meets as it circulates through the lungs, and to convey oxygen into the ultimate tissues of the body for supporting the combustion and the nutritive changes, is perverted. Thereupon the healthy state of the body is rendered impossible, and various modifications of organic functions are set up, which, if long continued, lead, of necessity, to natural perversion of function and proclivity to disease.

Increase of the White Corpuscles of Blood. Leucocythæmia.

Besides the red corpuscles there are, as we know, in the natural blood a number of other corpuscles, far less numerous than the red, which corpuscles are colorless, called therefore the white or colorless corpuscles of the blood. In some forms of disease, especially from changes in certain organs of the body, as the spleen, the white corpuscles increase, and the blood becomes surcharged with them, the red corpuscles being at the same time relatively decreased. The disease so produced is called "white blood cell disease," or leucocythæmia, a disease of serious import.

It is accompanied with paleness of the body, great languor and depression, and impaired nutrition. White blood cell disease is probably hereditary in character, and up to this time has been little amenable to treatment. It was discovered in 1845 by the late Dr. Hughes Bennett of Edinburgh, one of the few illustrious in medicine of this age.

Poisoned Conditions of Blood.

The blood, lastly, may be charged with poisonous substances which so interfere with its function that death may be the result. These poisons may be derived from without, as when a gaseous or vaporous body, such as nitric acid vapor, or chlorine gas, or ammonia vapor is inhaled; or they may be derived from rapid changes excited in the body itself by some animal poisons, such as snake poison, with which the body has been inoculated; or they may be derived from substances which are natural to the body formed in excess, such as urea, the natural soluble salt of the urine. In yellow fever ammonia has been formed in such excess in the body as to reduce the blood to a fluid like port wine in consistency, the corpuscles being dissolved altogether, and their coloring matter being diffused through the whole mass of the blood like a dissolved coloring principle or dye.

CHAPTER IV.

LOCAL DISEASES OF THE BREATHING OR RESPIRATORY SYSTEM.

UNDER the respiratory system is included all the organs and parts concerned in the act of respiration or breathing; the nostrils, larynx, and glottis; the trachea or windpipe; the bronchial tubes; the structure of the lung proper, including the air-vesicles; the pulmonic vascular plexuses; the nervous filaments; the elastic connective tissue; the covering of the lung or pleural membrane; and the space between the lung formed by the meeting of the pleura of each lung—the mediastinum. The diseases of this system represent a numerous class.

NASAL CATARRH. CORYZA.

Nasal catarrh is a discharge of fluid from the nose, called also common cold. It is a well-known affection, becoming often epidemic, lasting usually from three to five days, and, when severe, attended with pain and sense of weight in the head, pain in the limbs, great depression of the physical powers, and irritability and inactivity of mind. There is usually a few degrees of fever during the presence of catarrh.

CROUP.

A diseased condition of the larynx and trachea, in which the breath is drawn through those parts with difficulty, and with the production of a hard or croupy sound, which may become so intense as to be actually ringing and shrill. There are two distinct varieties of croup, the spasmodic and membranous.

Spasmodic croup.—Called sometimes *Laryngismus Stridulus.* A spasm of the glottis or opening through the larynx into the windpipe and lungs attended with croupy breathing. The dis-

ease is sudden in its onset. It is usually produced by nervous irritation at some part distant from the larnyx, as the stomach, or intestine, or the gums during the process of teething, the irritation being reflected, through the nervous communications, to the muscles of the glottis. The spasm will often cease as suddenly as it came, but it is apt to recur in those who have once suffered from it. Occasionally it proves fatal by the asphyxia or suffocation it produces ; but, as during suffocation, there is a tendency to relaxation of the muscles, death is not so frequent as it might be expected to be from spasm in so important a part of the respiratory tract.

Membranous croup.—The membranous or *inflammatory* variety of croup. A dangerously fatal affection. It begins often with signs of cold and hoarseness, but may be developed without these preliminary warnings. It consists of a suddenly developed inflammatory condition of the larynx and windpipe, followed quickly by an exudation, upon the lining surface of those structures, of a layer of fibrine or lymph, which mechanically obstructs the passage of air, and which, if the exudation be large and be not coughed up, causes, in the absence of surgical intervention, death by suffocation. The disease is rare after childhood, affects boys in greater number than girls, and is not contagious. From the severity of the throat affection it is considered as a local disease; but it is now known that in the croupy condition there is an increase of fibrine in the blood, and a tendency to separation of fibrine in the heart, so that the local manifestation is probably only a part of some general systemic disturbance.

Diseases of the Larynx.

The larynx, the cavity or enlargement at the upper part of the windpipe, and which is marked out in the neck at the prominent part vulgarly called " Adam's Apple," is subject to several forms of disease, the following being the chief.

Inflammation and ulceration of the epiglottis.—Inflammation of the valvular structure, which is situated at the top of the larynx, and which falls down in the act of swallowing, to prevent liquids and solid particles from entering the glottis. Inflammatory disease of the epiglottis or valve may be followed by ulceration or loss of structure, and in some constitutional states, the

syphilitic especially, the ulceration may occur without any previous acute inflammatory affection.

Laryngeal catarrh.—A catarrh or profuse secretion from the mucous surface of the larynx. A condition apt to become chronic, and to recur in those subject to it, particularly during the winter season.

Laryngitis.—Inflammation of the larynx without specific croupous exudation. An affection not peculiar to any age of life, and occurring in the acute and chronic form. It is, as a rule, an extension of inflammatory disease from the throat or from the tracheal and bronchial surfaces.

Laryngeal ulcer.—Ulceration of the mucous lining of the larynx, extending, it may be, into the cartilages of which the larynx is formed, and ending in necrosis, or death of the cartilages. This ulceration is most frequently seen in diseases of constitutional taint, such as syphilis, and pulmonary phthisis. It has consequently been divided into the syphilitic and phthisical types.

Laryngeal abscess.—A circumscribed formation of matter, or pus, involving the larynx, and usually following inflammatory disease of the part implicated.

Œdema of the glottis.—A swelling from exudation of watery or serous fluid into the structure of the edges of what is called the glottis, the opening beneath the epiglottis leading into the larynx and trachea. The disease is generally the result of accident, from swallowing or inhaling some hot or irritant substance. It occurs occasionally during erysipelas of the head and face, and I once knew it to happen during a severe attack of nettle-rash. It is a very dangerous affection.

Growths in the larynx.—The development of growths within the laryngeal cavity is a cause of local obstruction, happily rare. The growths may be one of three. *Warty growths*, composed of structure, rather firm, and attached to the inner surface of the cavity by a broad base. *Polypoid growths*, soft and gelatinous, attached by a pedicle. *Cysts*, or hollow growths, containing, in some instances, parasitic forms of life.

Paralysis, and aphonia or loss of voice.—In the larynx are situated the muscles which move the vocal cords, the cords which stretch across the glottis from the back to the fore part and by the vibration of which the sounds of the voice are produced. In paralysis of the muscles of the glottis the breathing

is rendered difficult, and the power of producing audible voice sounds is lost. The term aphonia is applied to the loss of voice,—*a*, not; *phōnē*, voice. Aphonia is of two kinds, the simulated and the true. The simulated form is of hysteric origin, and though it may last for long intervals of time, is temporary in character. The true is due to an actual palsy of the laryngeal muscles, is dependent on some important nervous injury or disease, and is, in most instances, a permanent affection.

Bronchitis and Bronchial Diseases.

Bronchial Catarrh.

A cold or catarrh affecting the mucous membrane of the trachea and bronchial tubes; commencing sometimes in a nasal catarrh, and at other times by itself. It is frequently epidemic, but is not contagious. It lasts from three to five days in its acute stage, and, when it begins in the early part of winter or spring, is apt to pass into a long chronic stage. In some persons it becomes a disease of annual occurrence, and is attended with very free secretion of phlegm and troublesome cough. The tendency to bronchial catarrh increases with advance of life.

Bronchitis.

Inflammation of the mucous tract covering the inner surface of the bronchial tubes. A common affection in this country, and fatal to large numbers of persons. It presents two forms, acute and chronic.

Acute bronchitis arises, in most instances of it, from taking a severe cold, but it may assume an epidemic form, and from the first be bronchial. There is with it in the earlier stages, chill, depression, a sense of constriction at the chest, difficult breathing, and pain. These signs are followed by fever, and continue until relief is obtained from free secretion of phlegm from the congested mucous surface. Acute bronchitis is peculiarly dangerous to the young, the old, and the enfeebled of all ages.

Chronic bronchitis is in the ordinary way a sequence and continuance of the acute type of the disease. It may nevertheless be developed without the indications of a very acute attack. It is often recurrent in those who have once suffered from it, and

probably in this kingdom there are more permanent sufferers from chronic bronchitis than from any other disease whatever. It is attended with constant cough, and an expectoration that is often profuse. In the young it may assume a form so severe as to make it imitate phthisis or consumption, and the term *bronchial phthisis* has been invented to define that form of disease, recoveries from which have, without doubt, often been mistaken, by ignorants and pretenders in physic, for recoveries from actual or tubercular consumption. Chronic bronchitis is very fatal to the aged, and it tends to become more determinate with increasing years.

In addition to these ordinary forms of bronchitis there are other forms in which the disease is induced, as by the inhalation of various vapors, gases, and dusts. It will be shown in a future part, that the affections thus, mechanically, excited run much the same course as when they follow more common causes, and are attended with similar dangers. They are peculiarly fatal to certain of our industrial populations.

Capillary Bronchitis.

Some authors have recognized, and I think correctly, a variety of bronchitis, acute and chronic, of the fine bronchial ramifications or capillaries, by which the bronchial tubes communicate with the air vesicles. To this type of the disease the term capillary bronchitis has been applied. It is a disease intermediate between bronchitis and inflammation of the lung,—pneumonia,—and it has also been described as pneumonia, under the name of catarrhal pneumonia. It is, in my experience, always sequential to bronchial catarrh or bronchitis, and therefore I venture to place it under the head of bronchial diseases.

In the bronchial tract there may, finally, be developed various foreign growths; tumors, malignant or cancerous, and non-malignant; cysts; and, parasitic developments. Occasionally foreign bodies from without are carried into the bronchial tubes and lodge in them.

Bronchial Structural Changes.

The bronchial tubes are subjected to various other changes, of which the following is a brief summary:—

Ulceration.—A condition in which there is a circumscribed

destruction of the mucous lining of the bronchial surface; an ulcer.

Cast deposits.—A condition in which a semi-organized deposit of a fibrinous character is laid down on the bronchial mucous surfaces so as to take the cast or shape of the tubes. Such tubular casts are, in some rare instances, coughed up entire.

Necrosis of cartilages.—The cartilages of the rings of the windpipe, and even of the large bronchial tubes into which the windpipe bifurcates or divides, may undergo necrosis or local death, under constitutional taint. There are two forms of this affection marked by their respective taints, viz., the *syphilitic* and the *phthisical*.

Dilatation and contraction of the bronchial tubes.—The bronchial tubes, under long-continued disease, may become generally dilated, or dilated in parts, like the fingers of a glove, with contracted sections in other parts. The air passing through tubes so changed produces sounds of a blowing, wheezing, or whistling kind, which the person affected, as well as those near, may be able to hear. The dilatations which now and then are caused in the larger bronchial tubes, as a result of long-continued laborious breathing, may be virtually cavities in which large accumulations of secretion are held until they are removed by coughing and expectoration.

Asthmatic Diseases of the Lungs.

Spasmodic Asthma.

In the strict use of the word, asthma is a spasmodic disease, in which the organic muscular fibres surrounding the bronchial tubes are thrown into a state of acute spasm, so that the entrance of air into the air vesicles, in which the bronchial passages finally terminate, is impeded. The spasmodic paroxysms are often sudden and rapid, but may be unattended by fever. The breathing during the attack is very oppressed and difficult; the suffocation is severe; the body dark, often cold, and enfeebled.

Asthma may be excited in those who are subject to it by causes of irritation lying away from the lungs, and one of the most common excitants of it is irritation in the stomach or intestines, from improper food or defective digestive power. It occurs

in all periods of life, is hereditary in character, and rarely passes altogether away in those who are affected by it, although it may be much controlled by care in diet and regimen. Death is not common during the paroxysm, the relaxation incident to dying, if I may so express it, having in itself a tendency to cause relaxation of the spasmodically contracted muscular fibres. There are two varieties of asthma.

Pure spasmodic asthma.—As above described.

Symptomatic asthma.—In which the asthma is an attendant or indication of some other disease, such as heart disease. Thus we hear of cardiac asthma and bronchial asthma.

Hay Asthma.

Hay asthma, placed by the Royal College first in the list of the local diseases of the lungs, is a spasmodic affection occurring in some persons during the hay season, when the odor of fresh hay is present in the fields. There is, commonly, a sense of catarrh or cold in this affection, with some discharge from the nose, and with paroxysms of severe spasmodic cough, brought on much after the same manner as coughing and sneezing are brought on by taking snuff. The disease is supposed to be due to the inhalation of fine particles derived from the flowers of grasses, and which specially affect particular individuals. The powdered particles of ipecacuanha produce a similar condition in some persons. I have observed that from Russian hemp particles are given off which cause a most aggravated form of disease of a similar kind in susceptible subjects. Hay asthma continues as long as the cause remains in action, and it may be prolonged for several days, or even for some weeks, after the cause of it has ceased to exist in the air.

Industrial Asthmas.

Under the general term asthma, by which is meant difficult breathing,—not necessarily from spasm, but from disease caused by the inhalation of dusts which create destruction of function in portions of the lungs,—there are included several kinds of lung disease incident to different callings. We shall see the details of these affections more fully as we proceed, in another part of this work, but the typical asthmas thus referred to may be named, so as to make our record so far complete. They are :

Grinders' asthma; Miners' asthma; Potters' asthma; Flax-dressers' asthma; Millers' asthma.

These asthmas are all specially connected with the occupations by which they are defined.

Diseases of the Structure of the Lung.

Pneumonia. Inflammation of the Lungs.

Inflammation of the lungs, inflammation, that is to say, of the true structure of the lungs, the air vesicles, vessels, and the surrounding or investing tissues, which together make up the spongy texture of the lung, is called pneumonia. The disease commonly follows a nasal or bronchial catarrh, or bronchitis, but it may assume an epidemic character, and may begin without any preceding affection. The disease is accompanied with high fever, difficult breathing, darkness of the countenance, and, after a time, with cough and expectoration of a rusty-colored fluid, due to the presence of the coloring matter of blood. Pneumonia runs a definite course, and, like some fevers, has its critical days, but it is not contagious. Essentially the disease is one, but various writers upon it speak of it as of different varieties. (*a*) Right and left, and double pneumonia, according as the right or left lung, or both lungs, may be affected. (*b*) Acute pneumonia; when the disease is running its acute course. (*c*) Chronic pneumonia; when the disease is attended with less fever, and the symptoms are prolonged. (*d*) Lobular pneumonia; when the disease is confined to portions of the lung structure. (*e*) Diffuse pneumonia, called also interstitial pneumonia, when the inflammation involves large portions of the lung structure. (*f*) Broncho-pneumonia, when the pneumonia is combined with bronchial inflammation. (*g*) Pleuro-pneumonia, where the disease is combined with inflammation of the pleural membrane. (*h*) Secondary pneumonia, when the disease comes on during the existence of other diseases of the body, especially febrile diseases, such as typhoid, typhus, small-pox, measles, erysipelas, and pyæmia. In this secondary form it is frequently the immediate cause of death.

Abscess of the Lung.

A circumscribed accumulation of matter or pus in the structure of the lung, following general inflammation, or produced by

some local irritation, such as the deposition of tubercle. It is occasionally produced by the presence of some foreign substance that has been lodged in the lung.

Gangrene of the Lung.

Gangrene or mortification of the lung structure usually occurring in the last stages of the worst forms of pneumonia, and in rarer instances from obstructed circulation. It is almost always a fatal disease when it extends over a large surface even of one lung. The affection seems to have been more prevalent in former days than it is at present.

Passive Pulmonary Congestion.

Passive congestion of the lung is a condition in which there is stasis or arrest of the circulation of blood from the right to the left side of the heart through the lung, in the course of the pulmonic circuit. The lung, in this instance, is engorged with blood in the affected parts. Pulmonary congestion is brought on by causes which lead to weakness or palsy of the minute vessels of the pulmonic circulation from withdrawal or reduction of nervous stimulus; or by weakness of the right side of the heart; or by obstruction of the left side. It is induced actively, by sudden exposure to cold; by over-fatigue; by the action of some narcotic agents; by long-continued use of alcoholic drinks; and by suffocation. The most common immediate cause is exposure to cold in persons whose pulmonic circulation is already enfeebled or diseased.

Hæmoptysis. Spitting of Blood.

Loss of blood from the lungs is what is commonly conveyed under the term hæmoptysis. Literally, the term means spitting of blood, but the source of the loss is so frequently from the lungs the phenomenon is as a rule connected with those organs. Loss of blood from the lungs is active or passive. *Active*, when pure blood is directly and rapidly given out; *passive*, when the blood, in small quantities, tinges other expectorated fluids. It occurs in the active form, from rupture of a vessel, or from great congestion of the lungs. It occurs in the passive form, from partial congestion or inflammation of the lung. It is a common accompanying symptom of pulmonary phthisis or consumption in both the early and the late stages of that malady.

Pulmonary Extravasation or Apoplexy.

An extravasation of blood from the vessels of the lung into the spongy structure. It takes place either from extreme congestion of the blood-vessels, or from rupture of them. Pulmonary apoplexy is often attended by passive, and sometimes by active hæmoptysis or spitting of blood.

Œdema of the Lung.

Œdema or dropsy of the lung is a state in which the watery part of the blood is diffused into the structure of the lungs. Œdema is usually the result of obstruction to the return of venous blood in the blood-vessels which supply the lungs with the blood required for their own sustainment, that is to say, the nutritive vessels of the lungs proper, as distinct from the vessels of the pulmonary artery.

Cirrhosis of the Lung.

A rare disease, in which the tissue of the lung in the whole, or in parts, is cirrhosed or hardened from condensation of the connective tissue. The disease is most commonly met with in persons who have indulged freely in alcoholic drinks.

Emphysema of the Lung.

A condition in which the lung structure is inflated with air beyond the natural filling of the elastic air vesicles during the act of inspiration. Literally it is a passive distention of the lung structure with air, and in a minor degree is analogous to the distention which the butcher produces in the lungs of a dead animal by blowing into them forcibly in order to inflate them before he suspends them in the shambles. There are two varieties of emphysema.

(*a*) The vesicular, in which the air vesicles themselves are distended and dilated.

(*b*) The interlobular, in which the air has escaped from the vesicles, owing to accidental rupture of them, and has diffused through the connective tissues and lobular structure of the lungs. It is this form of artificial emphysema the butcher produces in the lungs of the dead animal, and in the human subject it is commonly the result of accidents leading to great strain, as in the

strain of cough in whooping-cough and asthma. The most ordinary form of emphysema is that in which the air vesicles are distended and broken the one into the other. Men and animals so affected are said vulgarly to be "broken winded," and the term is wonderfully expressive. In aged people, in whom the elastic tissues of the body are much impaired and are wanting in resilience, emphysema is of such common occurrence that the term "senile emphysema" has been employed to distinguish it as a disease that has resulted from old age.

Atelectasis of Lung.

A term signifying deficient expansion of the lung by breathing, and applied to the lungs of a child after birth, when the act of breathing has not been perfected. The lung structure, wanting inflation by air, is condensed, heavy, and sinks in water.

Pulmonary Phthisis. Consumption.

A condition including various phases and characters of disease, in which the lungs are the active seats of the evil. Numerous terms are used by physicians to indicate the different phases of the particular affection, which, under its constitutional designation, is called consumption or phthisis pulmonaris.

Tubercular Phthisis. True Pulmonary Consumption.

True pulmonary consumption is that form of phthisis of the lung in which specific tubercular matter is deposited in the structure of the lung in small masses or tubercles, which masses become centres of irritation, inflammation, and suppuration or formation of abscess, ending in destruction of the structure of the lung and in the formation of what is called a cavity of the lung. The disease is constitutional, hereditary, and doubtfully contagious. It is most commonly developed in the period of adolescence, and in nine cases out of ten is first lighted up by cold or some nervous depression. Hæmoptysis is a frequent early symptom, and there is, usually, an acute stage with fever and a kind of inflammatory condition of the affected part of the lung, tubercular pneumonia.

The upper parts or apices of the lungs are usually the first affected. As the disease progresses, there is constant cough, frequent spitting of blood, and wasting of the body; three

symptoms, which taken together are typical of phthisis. In later stages there are recurrent paroxysms of fever called "*Hectic*," and profuse sweatings. The disease is very wide-spread in this country, and exceedingly fatal.

Acute pneumonic phthisis.—A condition in which pneumonia,—inflammation of the structure of the lungs,—is developed, in its acute form, in persons susceptible to phthisis.

Chronic pneumonic phthisis.—A condition in which chronic pneumonia is developed in the same constitutions.

Acute miliary phthisis.—A condition in which there is development or deposit in the lung of a tubercular material of a miliary character, resembling millet seed and widely distributed.

True tubercular phthisis.—A condition in which the ordinary form of tubercular substance is deposited in the lung in small separate masses, tubercles, which become centres of irritation, inflammation, and suppuration, followed by destruction of tissue, and cavities.

Industrial phthisis.—A condition in which the mischief in the lung structure, leading to phthisis, is produced by inhalation of substances to which persons following particular industries are subjected. Millstone dust, coal dust, flax dust, give rise respectively to millstone workers' phthisis, miners' phthisis, flax-dressers' phthisis.

Alcoholic phthisis.—The consumption of drunkards. A definition, first applied by myself, to a form of phthisis peculiar to some persons who indulge freely in alcohol. As a rule it occurs after middle age.

The various conditions leading to pulmonary phthisis fill up one of the greatest chapters in the history of disease as a whole, and the greatest of all the chapters in the local history of pulmonary diseases. Of all the organs of the body the lungs are most open to invasion of disease from causes operating both from within and without the body; and as in respect to every one of the phthisical maladies the hereditary law of descent is maintained, the lungs are, taking all in all, the organs most liable to the acquired as well as to the inherited types of the malady.

Diseases of the Pleura.

The pleura is the thin, elastic, semitransparent membrane which can so easily be stripped from the surface of the lungs. It envelops each lung as in a serous bag or sac, which is reflected

on to the inner walls of the chest, covering them, and which between its two surfaces produces a serous fluid for preventing friction or adhesion.

The pleura is liable to several varieties of local disease.

Pleuritis. Inflammation.

Inflammation of the pleural membrane in whole or in part is called pleuritis. The inflammation may be acute or chronic. In the *acute* form it is marked by fever, and by great pain in breathing. The membrane is injected, inflamed, and extremely sensitive, being brought in the act of breathing to rub on adjacent structures. In the *chronic* form the symptoms are modified and prolonged, but the pain in breathing remains exquisitely acute when a deep breath is fetched, or when cough is severe. Pleurisy, acute and chronic, is most apt to occur in persons of rheumatic and gouty constitution. It may exist as an independent affection, but is more frequently connected by sympathetic or organic influence with some other affection of the lung. It is a frequent complication of the other acute diseases of the lungs.

Empyema.

Empyema is an accumulation of purulent fluid or matter in the cavity of the pleura; that is to say, between the two layers of the pleural membrane. Practically, it is an abscess of the pleural cavity, resulting from inflammation, and from the inflammatory products thrown out during the inflammation.

Adhesion, Thickening, and Ossification of the Pleura.

Adhesion means the uniting together of portions of opposing pleural membrane which, in the natural state, would glide smoothly over each other with perfect freedom. *Thickening* means an enlargement, from deposit of plastic exudative material on the membranous structure, in patches or over the whole surface. *Ossification* is a transformation of a part of a pleural surface into hard structure, from calcareous or any deposition.

Hydrothorax. Dropsy of the Pleura.

Hydrothorax is an accumulation of watery or serous fluid in the cavity of the pleura. It is usually the result of inflammation, but sometimes is due to venous obstruction. The fluid may in-

crease until it fills the cavity, presses on the lung of the affected side or on both lungs, and even displaces the heart itself.

Pneumothorax.

Pneumothorax is a condition in which air has entered, and partly occupied, the cavity of the pleura. The accident sometimes occurs from rupture of the vesicles of the lungs together with the pleural covering of the lungs. At other times it is from an injury to the chest, as from fracture of a rib. In very rare instances it is from gases developed in the blood.

The pleural membrane may also be the seat of cancer, simple tumor, tubercle, and parasitic growths.

Diseases in the Mediastinum.

The space between the lungs, formed by the two pleural membranes which cover the lungs, and called the mediastinum, is sometimes a point in which local disease is manifested. Three such forms of manifestation are recorded.

(*a*) *Abscess*, or accumulation of purulent matter.

(*b*) *Cancer*, or formation of malignant tumor.

(*c*) *Simple tumor*, or growth of tumors which are "non-malignant," not cancerous.

Other Pulmonary Affections.

The lungs, finally, are liable to become the local seats of cancer and of parasites. They are subject to mechanical injuries from without, wounds; to impactions from inhalation of solid foreign materials; and to injuries from inhalation of corroding and irritating gases or vapors.

CHAPTER V.

LOCAL DISEASES OF THE NERVOUS SYSTEM.

In the nervous system the parts and organs subject to disease are the brain and its membranes; the spinal cord and its membranes; the nervous cords and their peripheral surfaces; the ganglia and nerves of the sympathetic chain.

The diseases of the nervous system are divisible into those which are functional and those which are organic. In fact, no diseases are so distinctly divisible into the two forms of functional and organic as those affecting this system of bodily organs.

It is always most difficult during life for the physician to make an absolutely correct diagnosis, or finding out, of either the acute or chronic diseases of the different parts of the brain and its membranes. The parts lie in close proximity; the sympathy between them is most intimate; and, the direct physical examination of them is impossible. It has therefore been necessary to invent a term that shall include in a word any one, or more than one, of the individual inflammatory diseases of the parts enclosed within the skull, and that word is *Encephalitis*, inflammation of the brain or its membranes.

At the same time the different parts, as examination of them in post-mortem inquiries have demonstrated, are the special seats of acute inflammatory diseases and of other resultant or degenerative changes.

Diseases of the Membranes of the Brain.

The membranous coverings of the brain and spinal cord are subject to both acute and chronic diseases.

Acute Meningitis. Brain Fever.

The old physicians gave the name of brain fever to a condition of disease which we moderns call acute meningitis, or inflam-

mation of the membranes of the brain. The dura mater, the firm external fibrous covering of the brain, is the part most frequently affected, but the irritation which is set up usually extends deeper, to the more delicate membranous structures beneath, the arachnoid and vascular pia mater. The disease is extremely serious, is attended with a high degree of fever, with extreme pain in the head, and with violent, often furious, delirium. It lasts for many days, and when recovered from often leaves permanent evidence of failure of nervous power. As an uncomplicated disease it is exceedingly rare.

Membranous Vascular Congestion.

The vascular membrane of the brain, the pia mater, may be the seat of extreme congestion. This is common under alcohol, and is a cause of the excitement which is present in that form of alcoholic poisoning known as delirium tremens. In one instance in which a man while in this state committed suicide by casting himself under a railway carriage, I saw the brain within four minutes after death, while still the fumes of whiskey were most readily detectable from it. The pia mater was injected to the extremest degree, lying like a velvety pile over the brain, and within the convolutions. In such examples the membrane, after many excitements, becomes firmly attached, in parts, to the substance of the brain.

Tubercular Meningitis.

In children and young persons of scrofulous or tuberculous constitution, the membranes of the brain are apt to become the seats of tubercular deposit from the blood. The deposition takes place, as a rule, beneath the dura mater, between it and the arachnoid; but I have seen it also in the upper surface of the membranes, between the dura mater and the inner lining, or periosteum, of the skull. Purulent matter may form with this exudation. The symptoms of the disease are practically those of brain fever, and the malady is usually fatal. It is a more frequent form of disease than simple acute meningitis, and it is followed in some instances by effusion of serous fluid and dropsy of the membranes of the brain, "*Acute hydrocephalus.*"

Chronic Hydrocephalus. Water on the Brain.

An accumulation of serous fluid in the investing membranes of the brain, between the brain substance and the outer and firm covering, the dura mater. The fluid is secreted by the middle or serous covering, the arachnoid membrane, and accumulates beneath the arachnoid, in the arachnoid sac or space, and even in the ventricles of the brain. The disease may progress with very little disturbance of the bodily functions until the head has attained an enormous size, the yielding bones giving way before it. The disease occurs in young children of strumous or scrofulous taint, and in the end is usually fatal. Latterly surgical art has been the means of saving life in some instances of it.

Thickening of the Dura Mater and Degeneration.

The dura mater is subject to a form of disease in which it becomes unduly firm and thickened in structure. In persons who are given to partake freely of alcoholic drinks, this thickening is very common. Some years ago, by the kindness of several professional friends, I was able to make an inquiry into the condition of the brain in that form of disease which has yet to be described as general paralysis. In every instance I found the dura mater thickened, firm, and dense, and often adherent to the membranes beneath it at one or more points. The resistance exerted by the membrane, as thus changed, tends greatly to the production of the paralysis, and I am of opinion that it is, in some instances, the cause of it.

The dura mater is also subject to various degenerative changes. It is sometimes affected with calcareous and osseous degeneration, so that it is transformed, in parts, into a bony structure. In one instance I observed a projection of bony matter of needle-shaped character, which passed an inch into the substance of the brain itself, and was probably the cause of epileptic seizures, from which the person in whom it was found suffered, and in one of which seizures he died.

Diseases of the Brain.

The diseases of the substance of the brain, as distinct from its membranous investments, are of several kinds. The more important of these are included under the following heads.

Inflammation of the Brain. Cerebritis.

Inflammation of the substance of the brain itself is of very rare occurrence, and the special symptoms by which it may be recognized are obscure. It is usually connected with inflammation of the membranes covering it, or is dependent, as the College authorities explain, on local injury or foreign deposit.

Abscess of the Brain.

As a result of inflammation and formation of purulent matter in the brain substance, abscess or encysted formation of matter may be present in the hemispheres of the brain. The positive diagnosis of brain abscess is very difficult, and its occurrence comparatively rare.

Congestion of the Brain.

Congestion of the brain is a condition in which the vessels are distended, and the gray and white matter are overcharged with blood. The pia mater is also surcharged with blood, and there may be excess of fluid secreted into the arachnoid space, and into the ventricles of the brain. Congestion of the brain is due, most commonly, to excitement and over mental work. It is easily produced by the free use of alcoholic drinks, by passion, by worry and excessive study. It is the origin of much nervous disease. The symptoms of it when it is evidenced in the acute form are extremely severe. There is feverish excitement, and it may be delirium, followed by extreme prostration. In the milder and more common forms the symptoms are: a sense of fulness in the head; dizziness; restlessness and desire for change; irritability of mind; sleeplessness; fits of slight fever followed by acid perspirations; and, extreme languor. Repeated many times cerebral congestion almost always leads to the production of some persistent and serious, if not immediately fatal, nervous disease such as diabetes or paralysis.

Bloodlessness of the Brain. Anæmia.

An opposite condition to the congestive is known as anæmia of the brain. In this condition the vessels of the brain are not duly filled with blood, and the structures of the brain, gray and white, instead of being vascular and red, are unnaturally bloodless

and pale. The condition is produced by exhaustion, mental and physical, and by insufficient food and nourishment generally. It may be the result of long-continued and excessive physical work and fatigue. The signs of it are a sense of faintness, ringing sounds in the ears, and somnolency. The somnolency may pass into deep sleep from which the person cannot be roused, *coma.*

Softening of the Brain. Ramollisment.

Several varieties of softening of the substance of the brain have been named by different authorities, and described as, *white or atrophic; red;* and, *yellow* softening. Atrophic softening is defined as a form of disease in which the brain substance undergoes what is called white softening, "the result of imperfect nutrition arising from deficient supply of blood, and in most instances dependent upon mechanical obstruction or degeneration of the cerebral arteries."

Red softening is a condition in which the brain matter, very soft and cream-like, is of reddish tint or color, the tint being derived from the red coloring matter of the blood. Red softening is assumed to have its origin in preceding inflammatory disease of the cerebral substance or in repeated and extreme congestion.

Yellow softening is a condition in which the brain substance is more nearly like cream, its color being of yellow white. This form is not considered to be of inflammatory origin, but rather a fatty degeneration, somewhat analogous to fatty degeneration of the heart, the brain-cells being transformed into fatty structures. The disease is connected, by some authorities, with anæmia of the brain, and is considered to be one of the results of that malady.

All these varieties of softening of the cerebral substance are irremediable, and are attended with failure or irregularity of nervous, mental, and muscular power.

Condensation of the Brain. Sclerosis.

An opposite condition of the brain to any of the varieties of softening is now known as condensation of the brain substance, or sclerosis. Sclerosis is a condition extremely similar to what has been before us when we were treating of disease of the lung known as fibroid disease. It is in fact a condensation or hardening of the connective tissue of the nervous structure, and the term sclerosis, the same in meaning as sclerotic in

relation to the outer coat of the ball of the eye, is therefore applied to it. The disease may be localized in the brain, or in the spinal cord, or it may extend through both. It may come on in early life; it may come on in later life; and it may be one of the degenerations of old age. When it is present in children they lapse into imbecility. When it attacks the aged it leads to failure, generally, of the vital powers, and to "the second childishness and mere oblivion."

Paralysis agitans. Shaking palsy.

When sclerosis affects the middle-aged it causes persistent motion of the limbs,—*paralysis agitans*,—a state of disease in which the sufferer cannot control a persistent agitation or trembling of the muscles of a part of the body, or even of the whole body, the tremor being attended with gradual loss of muscular power. Paralysis agitans lasts often for many years, ending usually in paralysis of some of the muscles of deglutition, or of some other of the muscular structures which are essential to life, but during sleep the agitation ceases altogether. This last fact I was able to observe in a person suffering with the disorder who was under my care for many years. I also found the agitation pass away under anæsthesia from chloroform and from methylene bichloride, but it is a slow and always progressive affection towards death.

Apoplexy.

Apoplexy means a blow or sudden shock by which a person is stricken down. In this country the people speak of it as "a stroke." The suddenness of the attack gives a natural meaning to the expression, for the person affected suddenly falls insensible, but remains warm, often becomes feverish, breathes with noise and difficulty, stertorously, and is sometimes convulsed. The disease is rare in persons under the middle stage of life. The symptoms are due always to some sudden pressure made on the brain, or to some sudden arrest of blood through the brain. Usually one of two accidents produces the phenomena. Either a blood-vessel of the brain gives way from diseased structure and blood is poured forth into the closed cavity of the skull, *sanguinous apoplexy;* or, the vessels are obstructed by coagula of blood forming in the sinuses, the veins which allow the blood to return from the brain; thereupon there is effusion of watery matter from the

blood, through the vessels, into the closed cavity; the pressure necessary to cause the phenomena is produced; and, *congestive or serous apoplexy* is the result.

Of late years we have learned to discriminate another and more limited kind of apoplectic seizure, in which the minute arterial vessels of some part of the brain become obstructed from coagulation of the fibrine of the blood in them, or from the conveyance into them of minute portions of fibrinous coagulated matter. From these causes there is developed a primary shock, not necessarily passing into complete insensibility, followed by some deficiency of power, or partial paralysis, which may be permanent, but from which there is often a fair recovery.

Sunstroke.

Sunstroke, sometimes called *coup de soleil*, is a form of apoplexy, attended in its acute representation with all the signs of common congestive apoplectic seizure, and supposed to be due to the direct action of the rays of the sun on the body, during tropical weather. There seem to be two varieties; one acute and purely apoplectic, specially affecting plethoric, full-bodied persons, who drink freely of stimulants, and who are prone to congestion of the brain; the other, less acute, in some sense resembling faintness in respect to the symptoms excited, and affecting the prostrated and enfeebled persons. I believe them to be entirely different conditions of disease; but being brought on by the heat of the sun, acting on different constitutions, they are usually considered as one, and are incorrectly designated by the same term.

Hypertrophy and Atrophy of the Brain.

Hypertrophy means an actual enlargement or overgrowth of brain substance generally. Atrophy means a wasting of brain substance generally. Both are conditions of great significance. As common diseases dependent on physical causes they are rare; but as conditions produced by mental activity or inactivity, respectively, they are, I suspect, common enough. In men of completely developed skeleton, in whom expansion of the skull is no longer possible, an extreme activity of brain leads to condensation of brain substance, and, thereby, to a form of hypertrophy which is easily transferable into degeneration. In persons of inactive brain and of mere automatic life, atrophy,—wasting of brain

matter,—attended with sluggishness and feebleness of mind, and faulty nutrition of body, is the more common form of brain disease.

Aphasia.

Palsy of intellectual speech is the nearest short definition of the disease which is known under the unfortunate term, aphasia. In aphasia the voice is clear, words can be spoken, and all the muscles mechanically required for speech are in perfect action; but the affected person, when he tries to express himself, uses words that may have no relation to the object he would define by them. Thus, in one example I knew of, the word "sack" was used for the word "chair." Aphasia is very frequently accompanied with paralysis of the right side of the body, right hemiplegia, and is due to some organic change, softening, or occlusion of blood in the nervous centre for articulate speech. Aphasia is very little amenable to treatment when it is fully established.

Tumors and Deposits on the Brain.

The brain is sometimes the seat of morbid growths, of which there are several kinds. The more common are: (*a*) Malignant growth or cancer. (*b*) Fibroid tumor not malignant. (*c*) Osseous or bony tumor. (*d*) Deposit of tubercular matter. (*e*) Parasitic cysts. The brain is further subject to changes from specific or syphilitic disease which may either be inherited or acquired.

Disease of the Blood-vessels of the Brain.

The cerebral arteries are very subject to disease. They may undergo: (*a*) Fatty and calcareous degeneration,—atheroma and ossification,—in which condition they sometimes give way and let out blood. (*b*) Aneurism or dilatation at one point. (*c*) General dilatation. (*d*) Closure or impaction from clots of blood or fibrine carried into them from the heart or from coagulation of blood in them. The sinuses or veins of the brain are also subject to occlusion from coagulation of fibrine within them.

Diseases of the Spinal Cord and its Membranes.

The membranes of the spinal cord,—dura mater, arachnoid, and pia mater,—being continuations of the coverings of the brain, are subject to the same diseases as were related of them on pp. 169–71, under the head of diseases of membranes of the brain.

Spinal Congestion and Inflammation. Myelitis.

I notice here two diseases which the "Nomenclature" distinguishes rather differently. The conditions I indicate relate to congestion of the spinal cord, followed sometimes by inflammation, myelitis, produced by peripheral or surface injury to the body. The researches on the action of cold on the skin in causing these conditions, made originally and coincidentally by Dr. Weir Mitchell of Philadelphia and myself, and since confirmed by Althaus and other observers, prove that the blood-vessels of the nervous centres and of the spinal cord may be paralyzed and congested by the influence of cold and other agents acting on the extremities of the nervous fibres on the surface of the skin. Central spinal derangement may thus follow upon exposure of the surface of the body to cold or injury.

The phenomena of spinal congestion and myelitis are: pain in the limbs and other parts supplied by the tract of nervous matter that is affected; fever; loss of power; paralysis, temporary or permanent in the muscles which receive their nervous stimulus from the affected tract; and, impaired nutrition in the same affected parts.

Spinal Atrophy.

Wasting of the spinal cord in the whole or in parts is called spinal atrophy. Loss of motor or sensational faculty, or of both faculties in the structures supplied with nervous stimulus from the affected parts, is the result of the disease. The atrophy is usually due to deficient supply of blood to the spinal cord, owing to obstruction in the blood-vessels, or to degeneration of them. The disease was called by the older physicians, *Tabes dorsalis.*

Spinal Hemorrhage and Degenerative Changes of Structure.

The vessels of the spinal cord are subject to similar changes as the vessels of the brain, under which changes they sometimes give way and allow blood to exude from them, a condition to which the name of *spinal apoplexy* is applied. The structure of the spinal cord, like the brain itself, may undergo, *white softening*, *red softening*, *yellow softening*, and *sclerosis.* It may also be the seat of malignant and non-malignant tumors, and of parasitic cystic growths.

Malformations. Spina Bifida.

The spinal cord is in some newly born children the seat of a peculiar malformation called Spina Bifida or Hydro-rachites. From the cord there protrudes, by an opening through the bony structure of the spinal column, a large soft watery tumor or sac which is made up of skin, dura mater of the cord, arachnoid, and serous fluid from the arachnoidal space. The opening in the spinal column is due to imperfect closure of the two lateral halves of the column before birth. The fluid secreted by the arachnoid membrane, finding no efficient resistance, pushes its way through the opening. The disease is now, in certain instances, amenable to surgical art.

General Diseases of the Cerebro-Spinal System.

The cerebro-spinal nerves, issuing from the brain and spinal cord and distributed over the body, are subject to diseases similar to the brain and spinal cord themselves. They may be subjected to inflammation, or *neuritis:* and to *atrophy*. They may also be the seat of a fibrous tumor growing on or between their bundles or fasciculi, called a nerve tumor or *neuroma*.

Paralysis. Palsy. Stroke.

The most important series of diseased conditions officially classified as connected with the cerebro-spinal nervous fibres or cords is included under the head paralysis or palsy, *stroke*, in which, owing to the failure of nervous stimulus to the muscles there is a loss of power of will to move parts under the control of the will; or loss of the will itself to control; or failure in a part to experience a sensation that would otherwise be received by it and communicated to the sensorium. Palsy of motion. Palsy of will. Palsy of sensation. No disease in the list of human maladies plays a more important *rôle* than paralysis. Paralysis is divided technically into many sections:

General Paralysis.—Paralysis of the insane. A palsy in which the whole voluntary muscular system shares more or less in the catastrophe.

Hemiplegia.—Half palsy. A palsy in which one lateral half or side of the body is stricken so clearly that it is customary to

define the condition by the use of the terms right or left; as right hemiplegia; left hemiplegia; according to the side of the body that is attacked.

Paraplegia.—Palsy in which the half of the body below the chest, and including the lower limbs, is stricken by the disease.

Locomotor ataxy.—Palsy indicated by ataxy, *i.e.*, irregular power of locomotion. The movements of the body are not correctly under the control of the will, and there is inability to walk forward without falling when the eyes are closed.

Progressive muscular atrophy.—A form of palsy due to gradual failure and wasting of the muscular organs, but commencing sometimes with apparent enlargement or hypertrophy of the muscles.

Infantile paralysis.—Palsy developed during infant life, and occasionally present from the time of birth. As a rule, this palsy is spinal in character, and is marked in special groups of muscles. It comes on with acute symptoms of fever and convulsive seizures, and ends in palsy of a limb, or limbs. The disease is probably allied to that form of paralysis described above under the head of spinal congestion and myelitis, and is due to some peripheral irritation acting on the vascular supply of the spinal cord. The disease sometimes terminates in permanent paralysis.

Local paralysis.—Paralysis of some special part or organ of the body. There are two marked forms of this paralysis. The first is *facial* palsy, in which the nervous supply of the muscles of the mouth and lower jaw is induced. The muscles of one side of the face are paralyzed, so that the balance of power between the two sides of the face, by which the natural expression is preserved, is lost, and the eye on the affected side cannot be closed. The second is known as *writer's* palsy, and is a form of palsy of the hand called also *scrivener's* palsy,—affecting, specially, writers, like conveyancers, who, in their formal, stiff mode of writing, rest the arm heavily on the paper or parchment, and press the hand heavily down. The whole nervous supply of the hand becomes, in these persons, impaired; they begin to direct the pen with difficulty; the hand feels benumbed and heavy; there are starts or cramps of the muscles; and, in time, if the affection progresses, there is complete loss of power, so that even the grasp of a stick or other object may be impossible. Another form of local paralysis is palsy of the upper eyelid, *ptosis*, from failure of

the third nerve, the motor oculi. The eyelid, in this instance, drops, and cannot rise in obedience to the will.

Diphtheritic paralysis.—A form of paralysis often very severe, following upon the disease diphtheria. The palsy, as stated under the head, diphtheria, in a previous chapter, affects chiefly the muscles used in swallowing, muscles of deglutition. It sometimes extends to the muscles of the neck, and even the limbs. It is, as a rule, recoverable, spontaneously, under conditions favorable to recovery.

Lead paralysis.—Palsy produced from the absorption of lead, by workers with that metal, and commonly affecting the muscles which raise the wrist. It is called from this circumstance, " wrist drop."

Functional Diseases of the Brain and Spinal Cord.

The diseased conditions above described are assumed to be dependent, always, upon actual change of structure, temporary or permanent, of the brain, spinal cord, or nervous cords. In addition to these nervous affections, organic in character, are some others which are technically classified as "*functional diseases of the nervous system.*" I reproduce this definition without being able altogether to subscribe to it. In the diseases to be named it may be true that organic changes in the nervous centres and cords cannot be so distinctly traceable as in other examples of nervous derangement, but that there is often structural as well as functional derangement can hardly be doubted.

Tetanus.

Tetanus, vulgarly called locked jaw, is an extremely agonizing and fatal disease, in which all the muscles of the body, during paroxyms of attack, are in a state of firm or tetanic,—*teínō*, I stretch,—spasm or stretch. The spasm is so extreme, in the worst examples of the disease, that the muscles may be torn by the violence. The muscles which close the jaw, and which are very powerful, are, as a rule, rigidly contracted, so that the jaw cannot be opened without the use of great force. Tetanus is of three kinds:

(*a*) *Traumatic*, in which it follows upon the infliction of a wound or injury.

(*b*) *Idiopathic*, in which it comes on seemingly from exposure to cold, or to cold and wet.

(*c*) *Venomous*, in which it is produced by the action of a poison, as by the poison strychnine, which of all known poisons induces the severest tetanic disease.

Death from tetanus usually occurs from spasm of the muscles of respiration, but sometimes from spasm of the heart, and more rarely from continued exhaustion. Until recently tetanus has been an incurable malady, but is now often amenable to treatment. Its precise nature has yet to be discovered.

Infantile Convulsions.

Convulsions occurring during infancy. They usually proceed from some surface or peripheral irritation, such as cutting of the teeth, or irritation of the bowels from the presence in them of improper or partly digested food.

Epilepsy.

Epilepsy, vulgarly, but characteristically, known as "falling sickness," is a sudden seizure of insensibility, followed by convulsive movements,—*epi*, on, *lēpsis*, seizure. The attacks occur at various periods of time in those who are subject to them, and are like an explosion in their suddenness and intensity. They are often excited, in the susceptible, by some trifling external irritation, and many epileptics feel at the time of the attack an aura or breath, or a sound. The paroxysms are limited in duration, and recovery from them is rapid, and, for the time, complete. They have occurred in persons of the highest intellectual power as well as in those of the lowest. During the fit the face is livid, the features somewhat distorted, the breathing noisy, the limbs for a time convulsed, the eyes turned up, and the unconsciousness complete. Death rarely takes place during the attack, unless the unconscious sufferer happens to fall in such a manner as to be fatally injured or suffocated. The disease is hereditary, and the advent of it is peculiar to no age after infancy; but true epileptics, though they may not die from the seizure, rarely live to old age.

Epileptic vertigo.—There is a minor form of epilepsy called by the French *petit mal*, by us *epileptic vertigo*. In this form the seizure is less pronounced; the aura is not so distinct; and, the person affected, though conscious of giddiness, vertigo,—or

sensation of turning round,—and of much confusion of thought, may not actually lose consciousness, or complete want of self-control. Epileptic vertigo is a recoverable form of disease, and by some physicians is called "*epileptiform*," to distinguish it from true epilepsy.

Convulsion and Spasm.

Convulsion or spasm are terms used to define uncontrolled actions of the muscles. In convulsion the contraction of the muscles alternates with relaxation, and opposing muscles contract one after the other, so that active movements of the limbs or other parts, over which the affected muscular organs are distributed, take place. In spasm the muscles are held in a state of permanent contraction, one set of muscles, or, it may be, opposing sets of muscles, being in some instances equally affected at the same time. Convulsion is contraction of muscle with alternate relaxation. Spasm is contraction long continued, until either the muscle or nervous stimulus is exhausted. *Cramp* is spasm of an extreme kind, prolonged, rigid, and acutely painful, but usually confined to one part, as the calf of the leg. The voluntary as well as the involuntary muscles may be affected by spasm.

There are many varieties of spasmodic disease, of which the following are the more striking:

Laryngeal spasm, laryngismus stridulus or spasmodic croup.—A spasm of the muscles of the glottis or opening into the windpipe, by which a crowing or croupy cough is produced, with hard or stridulous breathing. It is a disease often fatal to young children, and due to some surface irritation reflected to the nervous centres which form the muscles of the glottis.

Intestinal spasm.—Colic.—Spasm of the intestines. It is due to irritation from improper food; or to cold; or to the action of some poisons, especially lead; hence the term "lead colic."

Chest spasm.—Angina pectoris.—A sudden and painful spasm of the muscles of the chest, including the heart, and seizing the sufferer with such sudden violence that the term "breast pang" has been employed to express the paroxysm.

Chorea. St. Vitus' Dance.

A disease in which the muscles of the voluntary order are in frequent motion without either the direction or the control of

their possessor. In some instances single tracts of muscles are affected, in others all the large tracts of voluntary muscular fibre. The disease might be called a paralysis or palsy of intellectual direction of muscles, the nervous stimulus flowing, if I may so express it, of its own accord into the muscular organs without any individual controlling power being exerted over it. The phenomena present themselves at all ages, and the affected seeming to move constantly are said to have a dancing disorder,—choros, a dance. Recovery sometimes occurs. The disease is technically divided into two varieties, (*a*) *acute*, (*b*) *chronic.*

Hysteria.

A functional disorder probably of the great sympathetic or organic nervous system, during the existence of which almost every other disease of a nervous kind,—even such a disease as tetanus,—may be simulated without practical danger to life. As a rule, however, the symptoms are special, consisting of emotional excitement with tendency to sighing, crying, laughing, with a peculiar sense of suffocation, or ball in the throat, and often with singular muscular movements and convulsion. The disorder is most common amongst women, but is not confined to the female sex altogether. It is rarely fatal, although, I believe, I once witnessed a death from hysterical convulsions. Hysteria is inclined to pass away with increasing years even in those who during early life are most subject to it.

Catalepsy.

Catalepsy is a condition of body in which the whole frame lies quite prostrate and helpless,—*kata*, down, *lēpsis*, a seizure,—so that a limb lifted up falls back as if it were relaxed and dead, while yet the consciousness of the person affected is retained without physical pain. In this state persons have been taken for dead, or have been said to lie in a condition of trance, although the word trance more exactly defines a long hysterical sleep, during which the consciousness is replaced by dreams. Catalepsy occurs most commonly, though not exclusively, in the female sex, and in many instances is connected with one or other forms of hysteria. The motions of the heart continue, and can usually be detected by the skilled observer. Respiration is also detectable. Catalepsy sometimes ends fatally.

Neuralgia.

Neuralgia is an extremely painful affection of the extremities of the nervous fibres, occurring in some constitutions with periodic regularity, and much influenced as to its occurrence by conditions of the weather. The pain is sharp and lanciolating during acute paroxysms, and dull and wearing after the acuteness of the attack has subsided. The pain is commonly felt to be pulsating, throbbing, and often synchronous with the arterial pulse. Muscular startings near to the affected part are also experienced. There are five recognized varieties of neuralgia: *Facial*, or *Tic doloreux*, Neuralgia in the face. *Brow ague*, or *Hemicrania*, Neuralgia in the head. *Sciatica*, or Neuralgia in the sciatic nerve. *Pleurodynia*, or Neuralgia in the pleural membrane of the lung. *Irritable* or *stump*, Neuralgia in the stump of a limb after amputation.

Hypochondriasis.

Hypochondriasis is a persistent affection often hereditary, and occurring more frequently in men than in women. During the attack there is, apparently, great depression of mind, without actual mental disease. The patient is afflicted with ideas of fancied diseases of the most varied kinds; ideas of impending miseries and dangers; sensations of swellings and contortions of the body which are or may be purely imaginary; descriptions of pains and sufferings which if real would quickly destroy life; and, altogether, a dread of disease and death which at last finds expression in terms so frequently repeated as to give rise to automatic repetition, in the same words, of the same sensations, to the real pain of those who are obliged to listen to the narrative. The disorder may be called a bad form of hysteria. The ancients referred its seat to the region of the stomach, hence the term,—*hupo*, under, *chrondros*, a cartilage,—under the cartilages of the lower ribs.

Mania.

Mania is an irregular condition of the mind in which there is false notion of existing facts and things, personal or general, together with excitement, extending from mere warmth or haste of expression to actual frenzy. There are two varieties of mania, the *Acute* and the *Chronic.*

In the acute form the excitement or frenzy is extreme, and follows closely on the delusion or derangement of ideas. In the chronic form the delusion or derangement is confirmed, but is more in abeyance, while the excitement is subdued and is at longer intervals of time. Mania assumes various types, according to the bent or turn of mind of the affected. Hence there is religious mania, monomania, dypsomania, and the like.

Melancholia.

Melancholia is a form of mental derangement, marked by extreme depression generally, with much lassitude and feebleness of body. The mind is often filled with sad and hopeless thoughts, and with frequent disposition to commit self-destruction as the nearest and shortest method of closing a miserable and intolerable life. Melancholia is by some classed as a monomania, the mind of the sufferer being, as it were, turned only upon himself, and in that sense it may, correctly, be called monomania. The disease is most commonly developed in grown-up persons, but indications of it are often temporarily present in those subject to it during childhood. It is almost invariably attended with functional disturbances of the organic nervous system, with dyspepsia, irregular motion of the heart, and sleeplessness. It is frequently attended with a peculiar odor or fetor of the breath.

Dementia.

Dementia may be taken literally as a want of mind,—*de*, from, *mens*, the mind. It is a condition in which there is feebleness of intellectual grasp or attention, imbecility of word and act, and general deficiency of mental power. There are two varieties of dementia, the *Acute* and the *Chronic*.

Acute dementia is a sudden development of feebleness of the intellectual power occurring in persons hitherto healthy and possibly actively or over-actively engaged. The chronic form is one in which the symptoms approach very gradually, and pass slowly into what may be called true mental death, as in old age.

Dementia is commonly attended with failure of the physical powers; but this, in the early part of the disease, is not necessarily correlative.

Imbecility.

Imbecility is a condition in which the mind is, from birth, unfitted for the active and thoughtful duties of life, and in which the person affected is said to be "half-witted," or wanting in general intellectual capacity. The condition may be attended with moderately good health of body in early life, but as a rule there is some physical derangement connected with it, some inherent physical as well as mental feebleness due to a bad constitutional condition, such as scrofula. The family of imbeciles is, generally, very short-lived, the members of it dying of consumption, or of tubercle of the brain, or of diabetes, or of diseases dependent upon changes in the great nervous centres. Imbecility is, in many cases, of hereditary type, but, as with those who suffer from cretinism, the reproductive faculties of the imbecile are low, so that, happily, survival is not largely promoted.

Idiotcy.

Idiotcy is a born condition in which, with some constitutional physical taint, the mental faculties are below the natural intellectual development necessary for the maintenance of reasonable life. In the true idiot the head is of reduced size, and the capacity of the brain is considered to be insufficient for the manifestation of the full mental powers. The instinctive faculties and desires are either not controlled by the reason, or are imperfectly controlled. Many idiots are deaf and dumb, but most of them retain the power of sight. They are unimpressionable to a large extent. Their reproductive faculties are commonly either absent or in abeyance, and their lives are comparatively short.

CHAPTER VI.

DISEASES OF THE ORGANS OF THE SENSES.

THE diseases of the organs of the senses to be described in the present chapter are divisible into three groups according to the organs concerned. Diseases of the organs of sight, of hearing, of smell: of the eye, the ear, the nose.

DISEASES OF THE EYE.

Seventy-five diseases are officially tabulated as affecting the eyes and their appendages. Of these diseases, fourteen are referred to the mucous membrane which covers the eyeball from the point where the skin terminates on the upper lid to the same point on the lower lid, the *conjunctiva.* Nine are referred to the *cornea*, the convexo-concave lens, which forms the first transparency of the eyeball. Two are referred to the sclerotic *coat*, or outer firm white covering or case of the eyeball. Seven belong to the *iris* or curtain, in the centre of which is the opening called the *pupil.* Seven are connected with the *choroid* or dark coat, and the nervous expanse known as the *retina.* Two are assigned to the *vitreous humor*, the large, cellular, and partly fluid lens which fills up the body of the eyeball posteriorly. Four relate to the *crystalline lens*, the great refracting medium which lies between the curtain or iris and the vitreous humor. Three are classified as general diseases of the eyeball, and six as "defects of sight." Four are named as diseases of the *lachrymal apparatus;* eleven, as diseases of the *eyelids;* six, as diseases within the *orbits.*

Diseases of the Conjunctiva—The Ophthalmias.

Under the general term ophthalmia the diseases affecting the external covering of the eyeball,—the mucous membrane called

the conjunctiva,—are arranged in the series of fourteen varieties. These are all commonly known as inflammations of the eyeball, although it is not usual for them to extend actually into the internal structure of the eye, nor even beyond that part of the external structure which is directly visible and is bounded by the enveloping eyelids. The varieties of the ophthalmias are as follow :—

Pustular.—A form in which inflammation of the conjunctiva ends in the development of purulent matter in pustules. The disease occurs, usually, in the course of other diseases attended with pustular eruption, such as small-pox.

Purulent ophthalmia.—Ophthalmia of a contagious character, attended with a purulent discharge which is capable, by contact, of communicating the disease from one person to another. The contagious particles may be carried by the atmospheric air, and thus become the means of communication.

Purulent ophthalmia of infants.—Another form of purulent contagious ophthalmia occurring in infant life, especially in children who inhabit badly ventilated rooms and live under conditions leading to feebleness of body. Improper or insufficient nourishment is one of the most potent of these conditions.

Strumous or scrofulous ophthalmia.—An ophthalmia peculiar to those who are of scrofulous taint. It is often persistent in its course, and leads, in bad cases, to impairment or even actual loss of vision.

Exanthematous ophthalmia.—An ophthalmia of an exanthematous or eruptive character, occurring sometimes during the presence of the ordinary exanthematous or eruptive diseases, such as measles and small-pox.

Gonorrhœal ophthalmia.—An ophthalmia connected with the disease called gonorrhœa, and produced by the contact of the specific discharge from that disease with the conjunctiva. An acute and very troublesome affection, leading occasionally to deep inflammation and loss of sight.

Chronic ophthalmia.—A slowly progressing ophthalmia, or a continuance, in a modified form, of one of the other of the varieties of ophthalmia in the slow or chronic condition.

In addition to these diseases the conjunctival membrane is subject to œdema, or dropsy, *chemosis ;* to fatty and other *tumors* attached to its surface ; to *parasitic* disease ; to *granular* change ;

to a triangular or wing-like red and fleshy formation called *pterygium ;* and to *metallic stains* derived from nitrate of silver, or from lead.

Diseases of the Cornea.

The cornea, the horny, transparent, cancavo-convex lens, which lies immediately beneath the mucous conjunctival membrane, is subject to the following local affections :

Keratitis, or acute inflammation of its structure.

Chronic interstitial keratitis.—Inflammation of long standing, with interposition of fluid between the layers of which the cornea is composed.

Keratitis, with suppuration.—A long, continued inflammation of the cornea, with formation of matter or pus in the layers of the structure. The appearance produced by the presence of the purulent fluid has caused the term *onyx* to be applied to the affection.

Ulcer.—A condition, following usually upon inflammation, in which there is active destruction or loss of substance of the cornea.

Leucoma.—An opacity of the cornea, due to a cicatrix.

Arcus senilis.—A white line running round the cornea at its circumference, in whole or in part, and commonly seen in the old or prematurely aged. The white structure is composed, chiefly, of fatty substance. At one time the arcus senilis was viewed by practitioners of medicine as an outward and visible sign of fatty degeneration of the heart and other internal organs, and great importance was therefore attached to it ; but later experience has not so fully confirmed this inference as to render it absolute as a sign of internal disease.

In addition to the above, the cornea is subject to three other varieties of disease, namely, *conical* cornea, in which the structure is pushed forward in the form of a conical projection : *staphyloma*, or a white prominence of a dead and disorganized cornea : and, *parasitic disease*, hydatids of the anterior chamber immediately behind the cornea.

Diseases of the Sclerotic Coat.

The sclerotic or investing coat of the eyeball is subject to inflammation,—*sclerotitis*,—and to inflammation connected with

acute rheumatism,—*rheumatic sclerotitis.* These affections are extremely painful, and are attended with fever and much general disturbance of the body. The sclerotic is also subject to staphyloma, or protrusion from its surface, and to *tumors* attached to it.

Diseases of the Iris.

Six out of the seven diseases of the iris or curtain of the eye, named on the College list, are inflammatory in character, and the term *iritis* is used to denote them. In the simplest form of inflammation, the word iritis alone is employed. When a wound is the cause of the disease, *traumatic iritis* is the mode of expression. Sometimes the iritis is an accompaniment of other diseases, such as rheumatic fever, arthritis, or inflammation of joints, syphilis, gonorrhœa, or scrofula. Then the iritis is said to be *rheumatic*, *arthritic*, *syphilitic*, *gonorrhœal*, or *scrofulous.* The sequelæ of iritis are included under this same head of inflammation, and consist of adhesion of the iris to surrounding parts; exudation of lymph and protrusion; permanent contraction; permanent dilatation; closure; and, irregularity of the pupil.

Diseases of the Choroid and Retina.

The dark or choroid coat of the eye is subject to inflammation, called, technically, *choroiditis*, and to congestion of its vessels, *choroidal apoplexy;* but these are rarely, if ever, distinct forms of disease affecting the choroid coat alone.

Retinitis.—Inflammation of the retina, the nervous screen or coat lying in front of the choroid coat.

Amaurosis.—A disease of the retina, dependent upon various changes of the retinal surface, and ending in an inability of the nervous expanse to receive and transmit impressions from the outer world to the brain. Amaurosis may be produced by the exposure of the eye for a long time to a white, dazzling object, like snow, and "snow blindness" is the most familiar example of this disease. It occurs also from other accidents, as from lightning-stroke, and from blows on the head. It has sometimes its origin in degenerative changes of the retina, in inflammatory changes following exhausting diseases, and in sympathetic irritation. It is occasionally induced by smoking tobacco.

Muscæ volitantes.—Small specks or spots crossing the field of vision, generally floating, and often taking a slight upward direc-

tion, and then a downward course in a long curve. The specks assume different shapes; sometimes they are mere dark points, at other times they consist of a series of dark points held together in lines and angles like a loose web or net-work. Again they appear as rings, and not unfrequently as disks with a dark centre, resembling the magnified red corpuscles of the blood so closely that they might pass for them. Rings of this cellular shape occur singly, or in line, or in broken network. Muscæ volitantes appear in yet another variety of shape, namely, in straight, dark lines, arranged in zigzag forms, with the dark edges slightly illuminated. Muscæ are, as a rule, seen most frequently in the sunlight, and as if at some yards distance. They appear greatly exaggerated in a fog, and then seem to be within arm's-length of the observer. In extreme instances they are visible by gas and candle-light. They do not indicate actual organic disease of the structures of the eye, but are supposed to be from *débris* of cells floating in the vitreous humor.

Albinism.—A condition of disease existing in persons who are often called Albinos, and in whom the dark pigmentary substance of the eyeball at the back of the iris and in the middle or choroid coat of the eye is not duly secreted. In albinism the eye is seen of a red color within the pupil, and vision, during daylight, is extremely embarrassing and painful. The disease is hereditary, and is peculiar to some families of men and to some lower animals.

Diseases of the Crystalline Lens and its Capsule.—Cataract.

The word cataract is an unfortunate but long-used term for defining opacity of the crystalline lens of the eyeball. In cataract the lens becomes white and opaque at some point of its surface, or in the capsule which envelops the albuminoid substance,—globuline,—of which the lens is composed. The opacity extends until, at length, the whole of the lens may be involved, and blindness rendered complete. The process of development is usually slow in its progress, except in the case of saccharine or diabetic cataract, which may be developed in a few days. The process has been called the "ripening" of cataract by the surgeons, who have an operation for the removal, or depression, or destruction of the opaque lens, and who are accustomed to wait until the cataractous change is complete or ripened before they

perform the operation. A few years ago Dr. Weir Mitchell of Philadelphia discovered that cataract could be artificially produced by charging the blood of an inferior animal with sugar. In continuation of his most important research, I observed that the same condition could be produced by nearly all crystalloidal substances, salts, which would enter the blood and increase its specific weight.

There are several varieties of cataract:—

Hard cataract, in which the lens has become firm, condensed, and dark. The cataract of the aged.

Soft cataract, in which the lens is of bluish-gray tint, sometimes of fractured appearance and swollen or large. The cataract of all ages of life.

Fluid cataract, in which the lens is more aqueous than in soft cataract.

Traumatic cataract, in which the disease has occurred from an injury to the eyeball.

Diabetic or glucose cataract.—A cataract in which the disease is produced by the presence in the blood, in large quantity, of glucose or grape sugar.

Congenital cataract.—A form of soft cataract in which the opacity is developed at birth.

The tendency to cataract is hereditary, but the disease does not generally occur until late in life. Cataract is common to the lower animals,—herbivorous and carnivorous,—as well as to man.

Diseases of the Vitreous Body.

Synchysis.—The most distinct affection of the vitreous humor is synchysis, in which the membranous cells are broken up, and the humor, unnaturally fluid, is charged with minute scales. The eyeball is soft, and the iris, or curtain, hangs flaccid. Before vision is lost, bright starlike spots, due to the floating scales, are constantly seen. There is no chance, according to our present experience, of recovery. The disease may be due to a blow, or to slow inflammation, or to wounds inflicted on the eyeball during operations.

Morbid deposits.—The vitreous humor is the seat of morbid deposits. Flakes, or *débris* of its own membranous structure are the commonest deposits.

General Affections of the Eye, and Defects of Sight.

Glaucoma.

Glaucoma is an affection in which the globe of the eye becomes large, dull, and tense, with dilated fixed pupil, greenness of color beyond the pupil, and excavation of the optic disk. The disease, attended with much pain followed by loss of vision, exists in two varieties, the *acute* and the *chronic.* It is rather a common affliction, occurring more frequently in men than in women, and not usually commencing before the period of middle life. It has an hereditary character, afflicting those who are of worn or feeble constitution chiefly. It is frequently connected with a gouty or rheumatic constitutional taint.

Hydrophthalmia.

Hydrophthalmia is dropsy of the eyeball from an accumulation of the fluid secreted in the space between the inner surface of the cornea and the crystalline lens, in which space, called the anterior chamber, the iris or curtain floats. In this disease the eye is large, tense, and staring, and the pupil is dilated. The cornea may or may not be rendered opaque, and vision, if not lost, is much impaired. The disease is due to irritation of the lining membrane of the anterior chamber.

Weak Sight. Asthenopia.

Weak or enfeebled sight, though a term commonly used, is not easily defined as connected with any special change in the eyeball. It may be present from an irritable condition of the retina ; from a fluid state of the blood ; from a want of power to accommodate the eye to distances ; from nervous anxiety about the sight ; or, from the commencement of one or other of the diseases of the structures of the eyeball. Most commonly, I think, the term weak sight is applied to one of the two defects of vision that come next before us, myopia or presbyopia, before they are fully developed or while they remain undetected.

Short Sight. Myopia.

A condition of vision in which, from the greater convexity or the position of the lenses of the eyeball, the natural focus of

vision is not maintained. The rays of light being focussed before they reach the retina, objects have to be brought nearer to the eyes than is natural or convenient, in order that they may be correctly seen. It has lately been pointed out by Mr. Liebreich that this condition may be induced in children by the habit of leaning forward, with the face almost on the paper, in the process of learning to read or write. The disease is of hereditary character.

Long Sight. Presbyopia.

A disorder of vision, in which the conditions are the opposite from those which are present in myopia. The focus of vision is so deranged that objects have to be held at a distance inconveniently away from the eyes in order to be distinguished naturally. The disease is common to old age, hence the term presbyopia. Another term, *hypermatropia*, has been introduced to define true long sight. It is a common cause of asthenopia or imperfect vision.

Color Blindness.

A condition in which, from defect of vision, a person cannot distinguish colors correctly, nor tell one color from another. Dr. B. Joy Jeffries of Boston defines the condition as an inability to distinguish one of the basic colors "of the spectrum, red, green, and violet, from gray. A person may be color blind in any one of these colors, red blindness being most common, green next, and violet least." The same author computes that one person out of every twenty in the community is affected with color blindness. At one time it was assumed that the diseased state leading to color blindness was confined to the retina, but it is now known to be connected also with changes of disease in the optic nerve, or even in the brain itself. It can be produced by nervous shocks, and, strangest, perhaps, of all, it can be induced by some chemical substances taken into the body, specially by santonine and by alcohol. The disease is hereditary, and up to this time seemingly incurable in those who inherit it. The hypothesis as to its nature is that in the retina there is a corresponding nerve centre for each basic color, red, green, and violet, and that the color blindness is due to disease affecting these centres.

Astigmatism.

The term Astigmatism, irregular refraction, is applied to a defect of sight, by which the natural acuteness of vision is to some extent lost, owing to different refraction from different meridians of the eye; so that "rays of light derived from one point do not again unite into one point." The deviation of sight is monochromatic, that is to say, an aberration of rays of the same color. The cause of the aberration lies in the cornea or in the crystalline lens. There are two varieties, the *regular* and the *irregular*. In the regular variety the cornea is chiefly the seat of the irregularity. In the irregular variety the crystalline lens is the seat of the irregularity. Astigmatism is now very efficiently remedied, in many cases, by the scientific adaptation of artificial lenses or glasses.

Day and Night Blindness.

Day blindness is a term used to describe a disease in which the person affected can only see when the light is subdued, as at night. Night blindness, on the other hand, means a condition in which there is blindness except in full light. The causes of the two conditions are often vaguely defined, but night blindness is known to visit those, chiefly, who have been exposed to intense or tropical light. The term *Nyctalopia* is sometimes used to express the former and *Hemeralopia* to express the latter affection.

Diseases of the Lachrymal Apparatus and Eyelids.

The lachrymal gland placed at the upper and outer angle of the eyeball is subject to inflammation and to resultant structural changes. But the most common disease connected with the lachrymal apparatus is *obstruction of the lachrymal* duct, the duct which runs from the inner corner of the eyeball downwards into the nasal cavity, and which conveys the tears from the eyelids into the cavity of the nose to be dispersed there. The lachrymal duct, when obstructed, fails to allow the watery secretion to pass through it, and the tears then flow in continual current over the lids on to the cheek. Acute inflammation of the lachrymal sac, —*lacryocystitis*;—chronic inflammation of the sac; and *abscess* and *fistula* are other diseases of the lachrymal system.

The eyelids are subject to inflammation; to the small or painful follicular boil called a stye,—*hordeolum;* to abscess; inversion,—*entropium;* eversion,—*ectropium;* falling or palsy of the upper lid,—*ptosis;* cystic growths; and, cancer. The eyelashes are subject to, ingrowing,—*trichiasis;* and loss,—*madarosis.*

Derangements within the Orbit.

Strabismus.

Strabismus, or squint, is the commonest of the derangements of the eyeball within the orbit. The eye is involuntarily drawn from its straight position to one or other side, or obliquely towards one or other side, so that the natural axis of the eye at rest is not maintained. When the direction is inwards, towards the nose, the most common derangement, the strabismus is called convergent; when it is outwards it is called divergent. The error is due either to shortening of one of the muscles by which the eyes are moved within the orbit; or to spasmodic contraction of a muscle; or to paralysis of one muscle and relative over-action of the opposing muscle. Strabismus is in some cases an acquired affection; in others it seems to occur from hereditary proclivity. It often affects both eyes in the same person and in the same direction of error, double strabismus; or it may affect only one eye, single strabismus.

Proptosis, or protrusion of the eyeball; *abscess; tumors,*—malignant or non-malignant;—*parasitic cysts;* are other forms of disease occurring within the orbit. The orbital nerves are also occasionally affected with disease.

DISEASES OF THE EAR.

DEAFNESS.

Deafness is presented under three conditions:—

1. From functional nervous derangement.
2. From deficiency of development, deaf-mutism.
3. From disease of the auditory mechanism.

Deafness from functional nervous derangement may occur without any existing disease of the ear. Deaf-mutism may give

no actual indication of disease, though the organ of hearing itself is, probably, always defective and of imperfect development.

The diseases of the ear are catalogued under twenty-one heads. Four are connected with the auricle or outer projecting part of the ear; six with the external opening or meatus leading from the external orifice of the ear down to the drum; three with the drum itself; one with the Eustachian tube, or tube leading from the throat to the middle ear; three with the cavity of the tympanum or middle ear; four with the labyrinth or internal ear.

Diseases of the Auricle.

The outer part of the ear, the auricle, is the occasional seat of *gouty and other deposits*, which give rise to prominences and to irregularity of the structure; of vascular swelling,—*hæmatoma;* of *malignant and non-malignant tumors;* and, of *malformations.* In persons of slight and delicate organization the outer ear is often exceedingly small, though it may be perfectly shaped. In persons of large build and of full-bodied circulation the outer ear is sometimes large, the lower lobe pendulous and exceedingly large. As a rule, a large lower lobe of the ear indicates a free vascular supply of blood to the brain, and is, to some extent, a sign of epilepsy, and of other kindred nervous diseases. The auricle may also be subject to enlargement,—*hypertrophy.*

Diseases of the External Meatus, or Canal leading to the Drum.

Inflammation.—Inflammation of the mucous membrane lining the tube may be *acute*, attended with pain, swelling, throbbing, earache, and febrile disturbance; or *chronic*, in continuation of an acute attack, with less pain and swelling but with frequent discharge, and, in some instances, with ulceration of the mucous surface.

Abscess.—Formation of pus or matter within the passage, the sequel, usually, of acute inflammation. It is accompanied with much pain, general disturbance, and fever which does not subside until the abscess breaks or is relieved by surgical operation.

Accumulation of wax.—The natural waxy secretion of the ear under some exciting influences is produced in excess, and accumulates in the meatus. The wax so placed blocks up the

passage more or less completely, and causes temporary deafness, discomfort, and sense of fulness in the ear.

Polypus.—A soft and sometimes very vascular growth within the meatus, and attached often, by a broad base, to the mucous lining. Polypus of the meatus is apt to grow rapidly and to keep up a continual irritation and discharge, with deafness of the affected ear.

Sebaceous tumor.—A growth within the meatus, attached to its mucous lining, and containing waxy or sebaceous matter enclosed in it, as in a small bag or cyst. It is sometimes called molluscous tumor or growth.

Osseous tumor. Exostosis.—A tumor of a bony character, springing from the bony walls of the meatus beneath the mucous lining, pushing that lining before it and filling up a part of the calibre of the tube. This tumor of bone is often very painful, and a serious obstruction to the hearing. It is most frequently met with in persons of rheumatic or gouty tendency.

The meatus may also be the seat of simple tumors, cystic growths, fungous granulations, and foreign substances introduced into it from without.

Diseases of the Drum of the Ear or Membrane of the Tympanum.

The drum of the ear is the membrane which stretches across the meatus or tube at its lower part. It is a fibrous web, lined on the outer side by the mucous membrane of the meatus, and on the inner side by the mucous membrane of the cavity of the tympanum,—a continuation of the lining of the Eustachian tube which runs from the inside of the throat into the cavity. The drum is subject to several local diseases.

Inflammation.—An acutely painful affection attended often with deafness, and sometimes with faintness in the early stage, the general disturbance and subsequent fever being also severe. The drum is often left thickened or hardened and imperfect in function after undergoing inflammation.

Ulceration.—A destruction of surface of the mucous lining of the drum extending down into the true membranous layer beneath. An affection exceedingly painful, and frequently leaving contraction of the drum,—cicatrix,—and imperfect hearing after the healing of the ulcerated spot.

Perforation.—An extension of ulceration quite through the drum, so as to produce an opening from the external meatus into the middle ear. When the perforation is permanent there is a certain defect of hearing, which is, however, at times, lessened by accumulation of wax over the opening, and which can often be greatly ameliorated by the insertion of an artificial drum.

In forms of disease in which the mucous membrane of the throat is implicated in inflammation, the inflamed condition is apt to spread from the throat into the Eustachian tube, and so to produce "throat deafness." In extreme cases the drum is in this way affected from its inner surface, and is ulcerated and perforated or even destroyed. One disease specially gives origin to this serious mischief, namely, scarlet fever. In my experience, which is rather considerable on this point, four out of every six examples of perforation of the drum of the ear have been from scarlet fever.

Thickening and condensation.—The drum of the ear is apt, in the later years of life, to undergo a slow process of change by which it loses its resilience and becomes firm in structure, like to the nail of the finger. This condition, in which the vibration of the membrane is rendered imperfect, leads to permanent defect of hearing. The drum may also be subject to deposit of earthy or bony matter, and to collapse.

Disease of the Eustachian Tube.

The Eustachian tube is liable to inflammation from extension of disease from the throat. It is also subject to obstruction and contraction so that air cannot pass freely through it into the cavity of the tympanum. When this occurs the vibration of the drum is interfered with, there is pressure within the cavity, and a sense of fulness and deafness which is very oppressive. Great relief to the condition is now often rendered by the operative procedure of passing a probe or hollow tube along the Eustachian canal into the middle ear.

Diseases of the Tympanum or Middle Ear.

The middle ear, lined with mucous membrane from the Eustachian canal, and containing the three little bones, the malleus, incus, and stapes—"hammer, anvil, and stirrup"—is subject to—

Inflammation, ulceration and abscess of the mucous membrane.

Inflammation, adhesion and fixation,—anchylosis,—of the ossicles or small bones.

The small bones are also liable to inflammation of their membranous covering or periosteum; to rheumatic inflammation; to gouty inflammation; and to incapacity of motion. By inflammatory changes they may be destroyed and discharged; or they may become adherent, and lose their adaptability to the refined movements which are required in the adjustments for correct hearing.

Disease of the mastoid cells.—The mastoid cells,—the cellular departments of bone which surround and form the walls of the middle ear,—are subject to inflammation, with effusion into the cellular structure; to thickening with condensation; and sometimes, to constriction and reduction of the size of the cavity of the tympanum. When the drum of the ear has been perforated and destroyed by acute inflammation and ulceration, so that the middle ear is open into the meatus, and the small bones are destroyed, the mastoid cellular structure may also be disintegrated and discharged.

Diseases of the Labyrinth or Internal Ear.

The internal ear, with its vestibule, its semicircular canals, its cochlea, and exquisitely refined nervous arrangements, is never affected by disease without becoming the seat of serious disturbances, extending from it to the nervous system generally. The official nomenclature gives three varieties of disease as connected with this part of the body, namely,—

Organic disease, such as would result from inflammation of the membranous structure; *abscess,* and adhesion of parts; and, disease from *new growths,* simple or malignant, within the cavity.

Necrosis, or death of the petrous bone, the bone within which the internal ear is formed.

Deafness, resulting from functional or nervous derangement, from actual disease, or from deaf-dumbness.

To these there is added malformation of the internal ear, which is a cause, in fact, of deaf-dumbness, the fine mechanism of hearing in this part being undeveloped or impaired in development.

Reflex Nervous Derangement from Disease of the Ear, and especially of the Internal Ear and Auditory Nerve.

Tinnitus aurium, a noise in the ear, variously described as a ringing, a buzzing, a roaring, a singing or a grinding noise, is now considered to be often of nervous origin. The observations of many recent observers indicate that from diseased and disordered conditions of the internal ear, and of the auditory nerve which springs from it, certain important general symptoms of disease are induced, such as "ear vertigo," convulsive starts and movements, nausea, and various affections of the alimentary canal. Bearing on this point, Dr. Bucke, of London, Ontario, Canada, seems to me to have made one of the most important of modern suggestions, by showing that the auditory nerve possesses the characteristics of an organic nerve, and of being, as it were, a direct intercommunicating line between the outer world and the ganglionic nervous centres. Thus the nervous mechanism at the origin of the auditory nerve, or of the nerve itself, from being subjected to an inflammatory condition or sequel of inflammation, to direct shock or irritability from shock, or to paralysis from disease or injury, may become the seat of symptoms affecting the whole of the body through the nervous organizations, directly through the organic, and indirectly, from the organic, through the cerebro-spinal system.

Whether Dr. Bucke's observation should turn out to be correct or not, it is now certain that many symptoms of disease, hitherto believed to be of a general nervous character, have their seat or centre in the organ of hearing; and again, that the organ of hearing, in its turn, is subject to nervous derangements, and thereby, ultimately, to organic changes which are of the most serious import. Thus from pressure on the internal ear, and from congestion, inflammation, or exudation, within the labyrinth, there is produced a variety of vertigo or giddiness, "*labyrinthine vertigo*," to which the name of "Mesnier's disease," after the discoverer of it, has been applied. Lately, Dr. Woakes, with much facility of exposition, has indicated that earache in infants, and most important nervous disorders arising from acute disease in the ear, may, by sympathetic connection, be induced from the irritation from teething and from the exanthematous diseases; that some forms of cough may, by reflex direction, be dependent on

disease within the ear; and that vertigo, having its primary seat in the stomach and digestive system, is frequently developed through the inter-nervous relationships of the organic nervous chain and the auditory nervous apparatus.

The recent application of the electric balance by Professor Hughes, and the introduction of his most skilful instrument, the audiometer, have enabled the physician to make various new and important observations relative to disturbances in the internal auditory apparatus. Thus I have myself found that in instances of labyrinthine vertigo the degree of vibration that may bring on the particular symptoms connected with the affection can be accurately gauged, and the extent of the disease that is present estimated. In extreme examples the vibrations within a few degrees of zero, or point of absolute silence, are sufficient to excite the remote phenomena indicative of the local derangement.

DISEASES OF THE NOSE.

The diseases connected with the nasal cavities and olfactory apparatus are arranged, technically, under the following heads.

Hypertrophy.—A disease in which the skin and cellular tissue of the nose become large, the skin being vascular and mottled. It is a common result of alcoholic indulgence, not itself fatal, but often a sign of similar vascular changes in vital organs.

Warts, or watery excrescences upon the nose.

Sebaceous cysts.—Cysts attached to the nasal organ and containing fatty or tallow-like substance.

Acne rosacea.—A disease affecting the skin causing redness of the point of the nose, enlargement of veins, and an eruption of small tubercles, ending in thickening and minute scars. The affection is usually produced by alcoholic excess.

Ozæna.—A singularly painful affliction, consisting of a persistent fetid discharge from the nose, and lasting often for long periods of time. The disease is usually connected with death and decomposition of the soft or spongy bones within the nasal cavity. It is sometimes produced without any apparent cause, as if from something imperceptibly inhaled which excited ulceration. In many instances ozæna is constitutional in its nature, and inherited.

Ulceration of the lining membrane of the nose.

Hypertrophy of the lining membrane.

Diseases of the septum or division between the nostrils.—Abscess; perforation; ulceration; thickening. Tumors attached to the mucous surface.

Epistaxis.—Loss of blood from the nose.

Polypus.—A large soft growth occurring within the cavity of the nose, and creating great obstruction. There are two varieties of polypus: the *gelatinous* or fluid polypus; and the *fibrous*, a firmer variety in regard to structure, and of slower development. Polypus of the nose, of both kinds, sometimes passes back into the pharynx,—the opening at the commencement of the gullet. It is then called, *naso-pharyngeal polypus.*

Impairment of sense of smell.—An impairment arising from organic disease or functional derangement of the olfactory nerves, the filaments of which are distributed to the mucous membrane of the nasal cavity.

CHAPTER VII.

DISEASES OF THE ABSORBENT AND GLANDULAR SYSTEMS.

The glandular system is divisible, for the classification of the diseases that are connected with it, into three parts. 1. The lymphatic glandular system, consisting of the lymphatic glands and the series of lymphatics or absorbent tubes of the body generally, with those of the small intestines,—mesenteric glandular system. 2. The tubular or duct glands, with their ducts or canals, sacs or bladders, and other parts or appendages. 3. The ductless glands, or glands from which there is no tube or duct to convey away secreted or excreted fluids.

Diseases of the Lymphatic and Mesenteric Glandular System.

Diseases of Lymphatic Glands.

Inflammation and suppuration.—The lymphatic glands are subject to inflammation which may pass on to suppuration. They sometimes are acutely inflamed after the infliction of poisoned or venomous wounds, and sometimes, but rarely, after ordinary wounds and surgical operations. In strumous or scrofulous persons the lymphatic glands are liable to undergo slow or chronic inflammation ending in formation of matter and in bursting of the abscess formed. Glands which suppurate in this manner are very slow to heal, and in healing leave, in many instances, a deep scar, which occurring in the neck is vulgarly called "curl."

The glands are subject to inflammation during the specific disease called syphilis, and syphilitic inflammation of them is a common result. When, in the same disease, the glands in the groin suppurate, "*syphilitic bubo*" is said to have been produced.

In the true plague accompanied with the "plague bubo" the

lymphatic glands are specially implicated as local centres of suppurative changes.

Malignant disease.—The lymphatic glands are often involved in malignant disease, and become themselves seats of cancer. In cancer of the breast the glands of the axilla are often affected, sometimes before and frequently after the operation for removing the affected breast.

Hypertrophy and atrophy.—The lymphatic glands are subject to hypertrophy or enlargement, a condition very common in scrofulous persons, and perhaps almost exclusively confined to them. Indeed, scrofula, as a disease, is by some considered to be strictly an affection of the lymphatic glandular system. The enlargement of the glands may take two forms; an *acute* form, in which the swelling, rapidly developed, remains for a few weeks, and then subsides; and a *chronic* form, in which an acute swelling becomes chronic, or in which a gradual enlargement commences and steadily continues until the gland attains a large size, is extremely firm and dense, and, showing no tendency to suppurate, is very difficult to resolve or disperse.

The lymphatic glands may be seats of tubercular disease, and in persons of tuberculous taint are liable not only to be charged with the matter of tuberculous deposit, but to pass through the various changes incident to tubercular degeneration.

The glands are again in some instances subject to atrophy or wasting of their structure. This state is presented in persons who have been subject to great exhaustion and general wasting. The atrophy is in other instances local in character, the gland or glands affected being subjected either to external pressure, or to deprivation of proper nervous stimulus, diminution of the nervous supply which should, naturally, pass to them.

Disease of the Lymphatic Vessels.

The lymphatic vessels, like the glands, may be the seats of inflammation and of subsequent suppuration, and in examples of poisoned wounds the inflammation may extend through the vessels, from the point where the poison was absorbed, up to the nearest glands. To this state the term, "inflammation of the absorbents," is commonly applied. The lymphatics are further subjected to *obstruction* from pressure upon them, as from a tumor lying in their course, or from disease and obstruction in the

glands with which they are connected. During such obstruction the vessels may burst,—"*bursting of lymphatics*,"—and the lymph contained in them be exuded into the surrounding structures.

Lymphatic fistula is another condition of disease in which a lymphatic duct or tube becomes connected by a fistulous opening with some part outside of it through which it passes.

Lymphatic glands and lymphatic vessels are closely connected with all the vital organs, the lungs, the heart, the liver, the spleen, the stomach, the intestines. In all these parts they are subject to the various changes denoted above. The *bronchial glands*, which lie near the point of bifurcation of the windpipe into the bronchial tubes, are so far susceptible to inflammation, abscess, enlargement, malignant disease, and tubercle, that these diseases are classified in the official nomenclature as specially connected with them.

Diseases of the Mesenteric Glands and Thoracic Duct.

The mesenteric glands, the glands of the small intestines, lying within the layers of the mesentery, are specially named as seats of disease. These glands receive lymphatic vessels from the structure of the intestines, and also the tubes which spring from the villi of the mucous coat of the small intestine, called the lacteals, because the fluid they contain, derived from the digested food, is of a milky color. The tubes or ducts going out from the mesenteric glands terminate in the pouch, called the receptaculum chyli, which gives origin to the thoracic duct, the duct or tube that ends in the venous circulation. Thus these glands lie, as it were, midway between the digested food and the blood, and in them that change of the food which consists in its transformation into chyle is perfected. They play therefore a most important part in living function, and disease of them is extremely serious, since it leads to interference with the process by which food is changed into blood.

The mesenteric glands are subject to the same diseases as the other lymphatic glands. They may be the seats of inflammation, abscess, enlargement, cancer, and tubercle.

Mesenteric disease. Tabes mesenterica.—The disease to which the glands are most liable is tubercular deposit, a wasting and painful affection to which the name of "tabes mesenterica" has

been long applied; "tabes,"—wasting, signifying the leading symptom of the malady, and "mesenterica" the seat of the disease. In ordinary conversation the term "mesenteric disease" is used to denote this particular tubercular state of the mesenteric glands. Mesenteric disease is usually developed in the young who are of tubercular taint, and is attended with fever, pain in the abdomen, enlargement of the veins over the abdomen, swelling, much flatulency, sometimes dropsy, great disturbance of the bowels, and rapid wasting. It is often but not always fatal.

The *thoracic duct*, the duct of the mesenteric glandular system, is subject to *obstruction* from pressure upon it from tumors, and from inflammation of surrounding tissues and organs. The obstruction is attended with wasting of the body and exhaustion, but the detection of it is very difficult during life, and the occurrence of it is exceedingly rare. I have only known one instance in the human subject, and then it was complicated with disease of the liver.

Diseases of the Tubular or Duct Glands and their Parts or Appendages.

The glands included under this head possess a tubular structure, and have a canal or passage for conveying away the fluid which they have secreted or excreted. Some of them, like the liver, have a reservoir or bladder for temporarily holding a portion of the fluid which they throw out. One of them, the kidney, has not only a tube or duct, the ureter, leading into the reservoir or bladder, but another special tube, the urethra, leading from the bladder to the outlet from the body.

Diseases of the Salivary Glands.

The glands which secrete the saliva, and the ducts of which open within the mouth, are subject to *inflammation* and *abscess*. When mercury has been taken largely these glands are much irritated, secrete saliva freely, and are greatly inflamed and enlarged. The term *salivation*, or *ptyalism*, is used to express this state. In the communicable disease called *mumps* the salivary glands are enlarged and inflamed. The glands may also be the seats of growths, malignant or non-malignant, or may be involved in such growths.

Salivary calculus.—From glands which, like the salivary, are furnished with a duct by which their secreted fluids are discharged, a formation or deposit of a hard mass, or *calculus*, in the duct is apt to occur. The calculus produces considerable irritation and obstruction. Salivary calculus is a concretion of this nature in a salivary duct, the deposit being derived from the saliva. The calculus is largely composed of the same earthy substance as that which is sometimes deposited on the inner surface of the teeth as "tartar." These deposits are due, to a certain extent, to uncleanliness in respect to the teeth, but some persons are, in spite of cleanliness, disposed to suffer from them. The affection is most common in those who are of rheumatic and gouty constitution.

Diseases of the Pancreas.

The pancreas, the large gland situated across the abdomen below and behind the stomach, is subject to the same series of diseases as the salivary glands. The pancreas resembles a salivary gland in construction, and secretes a fluid which has some of the physiological qualities of the saliva. It is a large gland, six inches in length, and its duct pours its secretion into the part of the small intestine called the duodenum. The pancreas is subject to *inflammation* of its structure, and to *abscess*. It is sometimes the seat of *cancer* or malignant disease, of *fibroid degeneration*, and of *calculus* or stone. The pancreatic duct also may become the seat of *calculus*.

The effect of the pancreatic secretion on the food is to emulsify the fatty constituents, and to take an active part in the secondary digestive process. When the pancreas, therefore, is functionally or organically diseased, the digestion is seriously impaired, and in organic disease of the organ the fatty substances eaten as food may pass through the body unchanged in character.

Diseases of the Liver.

The large organ or gland called the liver, the largest gland in the body, is situated in the upper part of the abdomen immediately below the midriff or diaphragm. The liver is very subject to disease, and as its uses in the economy are many and varied, its importance, as a seat of disease, can hardly be over-estimated. It is a common practice for persons who are ailing to attribute their

suffering, as if by some instinctive process, to the liver and bile, and there is often a great deal of reason in the observation. The liver secretes bile, and much of the bile so secreted and thrown into the alimentary canal is absorbed there and is burned in the body; so the liver becomes indirectly a source of supply for animal heat. The bile, if it be not duly applied, and if it be returned into the circulation as bile, is a poison to the blood, a cause of depression to the spirits, and when in the blood in large quantities a cause of yellow discoloration of the skin,—jaundice. In the liver there is a translation of the matter derived from the digested food into a substance called glycogen, which is easily changed into glucose or grape sugar. If from irregular nervous action this process be improperly carried out, glucose may be formed and given over in excess to the blood. Thus the liver may become indirectly the origin of glycosuria or saccharine urine, and of the disease called diabetes.

The liver is often the receptacle of poisonous substances taken into the body, such as the metallic poisons, some vegetable poisons, and alcohol. These poisons will remain in the liver long after they have been taken, and some of them, as it would seem from researches I once conducted on the elimination of antimony from the body, are thrown out by the liver into the alimentary canal, to make the round of the circulation and to be returned to the liver for re-elimination.

The liver again is a frequent centre in which parasitic growths are developed, and in certain animals, the sheep for example, it is the special seat of one parasite, the liver fluke, the *fasicola hepatica*. The liver, it will be seen from these facts, is a great centre of disease and the seat of many distinct diseases.

Congestion.—The liver is sometimes the seat of vascular congestion, during which it is temporarily increased in size, to the discomfort of the sufferer, who feels pain which is often referred to the right shoulder. With this congestion there is always dyspepsia and flatulency, derangement of the bowels, and not infrequently piles or hemorrhoids. When the congestion is great, there is usually some yellowness of the conjunctiva or even of the skin, and there is always a pasty and anæmic look of skin. Congestion of the liver is most apt to occur in persons of sedentary habits, and especially, in such persons, when they indulge in stimulants and in rich food. It is almost universally attended

with depression of the mind, from whence, doubtless, the terms "bilious disposition" and "bilious feeling" are derived.

Hepatitis, or inflammation and abscess.—The liver is subject to inflammation, which may be simple or pyæmic; that is to say, the inflammation may originate in the liver itself, or may be one of the consequences of that condition of fever to which the word pyæmia is applied. In this climate the last-named is the most frequent form of inflammation and of abscess of the liver, the abscesses being numerous and small. In tropical climates, as in India, inflammation pure and simple and abscess of the liver, are of common occurrence, especially in those who indulge in alcohol.

Inflammation of the liver, however caused, is attended with high fever, pain, great disturbance in the abdominal organs, and jaundice. If abscess follow the inflammation it leads to enlargement of the liver, to irritative and hectic fever, to jaundice, and usually to death by exhaustion. When abscess of the liver is the result of simple inflammation, there is, as a rule, one large abscess, and in rare examples the abscess breaks externally and recovery is the result. I have known one such instance.

Degeneration of the liver.—The liver is subject to several degenerative changes which are classified as—(*a*) Acute atrophy. (*b*) Thickening of the capsule. (*c*) Cirrhosis. (*d*) Fatty liver. (*e*) Fibroid deposit. (*f*) Lardaceous, amyloid, or waxy liver.

Acute atrophy or contraction.—A condition in which the liver suddenly shrinks, its cells undergoing a rapid degeneration and becoming charged with oily and granular deposits. This disease is attended with extreme disturbance of the other organs in the abdomen, with arrested action of the kidney, ending in death by sleep, coma. There is sometimes yellowness of the skin or jaundice. The affection is rare, and except in pregnant women is almost unknown in this country.

Cirrhosis.

Cirrhosis is a condition in which the liver, after first being much enlarged, from repeated attacks of congestion, shrinks and becomes hard and rough on its surface, "hob-nailed." The disease has been called, from this appearance of the liver, "hob-nail liver." It has also been called, owing to its almost invariable connection with alcohol as its cause, "gin-drinker's liver." The disease is due originally to a change in the membranous structure

of the liver, produced, most frequently, by the direct action of alcohol on the membranous structure, and ending in the condensation and destruction of the secreting cells, with thickening of the connective tissue. The liver gradually contracts, ceases to secrete bile, and, becoming an obstruction to the venous circulation, produces ascites or abdominal dropsy, under which the sufferer generally succumbs. The term cirrhosis is taken from the yellow color, which the diseased liver structure presents. The color is due to a yellow pigment in the diseased cells. Cirrhosis of the liver, as a disease, is almost peculiar to the human subject, but in my experiments with alcohol it was shown that by administration of alcohol it could easily be induced in the lower animals.

Thickening of the capsular covering and fibroid deposit.—Distinctive conditions of disease of the liver, but less common than cirrhosis. By some authorities they are connected with the various stages of cirrhosis.

Fatty liver.—The liver is subject to a peculiar fatty degeneration in which the cellular structure is charged with fatty cells. The liver then resembles a fatty structure; it floats in water and is of yellowish tint. It is also much enlarged. Fatty liver is often connected with consumption of the lungs. It may be produced by indulgence in alcohol. It can be synthetically induced in the lower animals by alcohol, rich feeding, and cessation from natural exercise.

Lardaceous liver. Amyloid disease. Waxy liver.—In this condition the liver, from changes in its secreting cellular structure, undergoes a gradual enlargement and a transformation toward what is conveyed in the terms lardaceous, amyloid, or waxy. The affection is perhaps hereditary, and it is mostly, if not in all instances, connected with some constitutional taint, the syphilitic and scrofulous most markedly. It is slowly destructive of life, and causes death by some indirect influence on other organs of the body, or in combination with fatty changes in other organs, such as the kidneys or heart.

The liver may also be the seat of *cancer*; of *syphilitic deposit*; of *tubercular deposit*; of *simple tumor*; and of *hydatid cysts*—cysts containing the larvæ of the tænia echinococcus, a variety of cestode or tape-worm,—which may increase until they break and discharge their contents externally. In addition to these states of disease the great vein of the liver, the *vena porta*,

which returns the blood from the digestive organs to the liver, and from which blood the bile is secreted, is subject to obstruction from inflammation of its coats, and from deposition of fibrine within it. *Obstruction of the vena porta* is attended with suppression of the bile, constipation, dyspepsia, and in extreme cases with dropsy of the abdomen.

Diseases of the Gall-Bladder and Bile-Duct.

The gall-bladder or sac for holding the bile secreted by the liver, and the tube or duct connecting it with the liver, are liable to several forms of disease, viz., inflammation, ulcer, perforation, fistula, obstruction, and calculus or gall-stone. *Inflammation* of the bile-duct and gall-bladder is rarely if ever disconnected from disease of the liver, and is always a very painful affection. Ulcer is a destruction of surface from the mucous lining of the gall-bladder or tube. *Perforation* is an ulceration extending quite through the coats of the sac into the abdominal cavity. *Fistula* is an opening, from perforation, not into the abdominal cavity, but through the abdominal wall to the outside of the body, so that a fistulous opening from the gall-bladder or its duct is established, from which bile may be discharged externally. *Calculus of the gall-bladder, or gall-stone*, is a hard concretion deposited from the bile within the gall-bladder. This calculus, formerly said to be formed of inspissated bile, consists largely of cholesterine, a waxy substance of crystalline character which is derived from bile and which burns like wax. There may be one calculus in the gall-bladder, or more than one. I have seen six in one gall-bladder. The calculus takes different shapes, but very often a triangular or "cocked hat" shape, from having been moulded into that form in the neck of the gall-bladder. Calculus in the gall-duct is a cause of the intensest of human sufferings when it is lodged or impacted in that sensitive structure. The pain comes on in paroxysms which nothing removes except the escape of the stone into the intestine, or its return into the gall-bladder. In very rare instances the stone is discharged by a fistulous opening through the skin, and in the young it is often passed into the intestine, and discharged by the bowels. In persons of middle or advanced life gall-stone is often associated with an atheromatous condition of the vessels of the brain, those vessels having undergone a fatty change, with a deposit in their structure of the same

kind of waxy substance as that which is contained in the gall-stone.

Jaundice. Icterus.

The old physicians gave the name of jaundice to what they considered was a specific disease accompanied by universal yellowness of the surface of the body, with or without fever, with much depression, and in the worst cases with coma, ending in death. They connected the disease with the circulation of bile through the blood, and we do the same in this day, but we differ from them in that we consider jaundice to be a symptom of disease rather than a specific affection. Jaundice, in fact, accompanies many diseases acute and chronic, though it is naturally most intimately connected with diseases of the liver and the gall-bladder. The symptom may be caused by obstruction to the course of the bile from closure of the gall-duct; by over-secretion of bile; and again from failure of the process by which the bilious matter brought by the blood into the systemic circulation is utilized. Thus there is a true hepatic or liver origin of jaundice and a systemic origin. The first is connected with hepatic disease; the second with other diseases of a more general character, such as yellow fever, pyæmic fever, and bilious remittent fever. Jaundice though not a definite disease is often a dangerous complication of other diseases. It tells us that bile, which in itself is a poisonous product, is circulating in the blood and is acting as a direct source of danger.

Diseases of the Kidneys and Renal System.

The two glands in the abdominal cavity, called the kidneys, have for their function a purely eliminative intention. The fluid they excrete is the grand outlet for the nitrogenous excretes of the animal body. The fleshy parts of food that are not used, and the used-up parts of the muscular system of the body itself pass out of the body through the kidney. In the course of its revolution the fleshy material has become transformed from its colloidal state into a crystalloidal. It has ceased to be flesh, and has become a salt. It has ceased to be insoluble in water, and has become excessively soluble. It has ceased to absorb and hold water, and has assumed the power of fixing water so as to become, as it were, a part of water, flowing away with it as though it were

water itself. The nitrogenous salt which has thus been produced from muscular or fleshy substance, and which the kidney throws off, is called urea. It is a white crystalline substance tasting something like nitre, and possessing extreme solubility.

The kidneys also eliminate water very freely, in order to carry away the nitrogenous salt and to relieve the body of excess of water. They excrete some other substances. They excrete an animal acid, called uric or lithic, derived from fleshy matter. They excrete sulphates of sodium, potassium, and calcium, derived from food. They excrete phosphates of ammonia, calcium, and sodium, derived partly from food direct and partly from disintegrated or effete brain and nervous tissue. They excrete some organic salts and coloring matters derived from the blood, together with mucus from the lining mucous surfaces of the kidney, the ureter, the bladder, and the urethra or external passage. If we measured the proportions of all these parts as they exist in the urine, excreted by the healthy kidneys of an adult person in twenty-four hours, we should find in all forty-eight fluid ounces. If of this fluid we analyzed a thousand grains, we should discover fourteen grains of urea; eight and a half grains of other salts, sulphates, biphosphates and chlorides; half a grain of uric acid, and ten grains of coloring material with mucus; thirty-three grains in all. The remaining nine hundred and sixty-seven grains would consist of water.

The due excretion of all these parts is necessary for health, but the excretion of urea and water is specially important. The saline substance, urea, if accumulated in the body, acts as a poison, causing the comatose state called uræmic coma, or sleep. The suppression of excreted water in due quantity by the kidney is a cause of dropsy. Imperfect excretion of uric acid, or of other salts than urea, is a cause of local diseases such as calculus of the bladder or other parts of the renal system, and of gouty deposit in the joints. On the other hand, excessive excretion from the kidney is a cause of exhaustion, and as the kidney is the channel by which many soluble saline substances find their escape from the body, its excessive excretive action becomes often a most urgent symptom in disease. The affection known as diabetes mellitus is a case in point. In this disease the blood is surcharged with the soluble saline substance called glucose or grape sugar, and as the sugar dissolved in the renal excretion is elim-

inated by the kidney, the flow from the kidney is frequent and, it may be, many times more abundant than is natural. In past days it was thought that the cases of excessive flow of water from the kidney was from disease of that organ itself. Now we know that the excessive flow may be but a symptom, and that the kidney may be quite healthy though forced to perform an extra amount of work. The diseases proper to which the kidneys are subject are congestion, inflammation, hypertrophy and atrophy, degeneration, and mechanical disease.

Congestion.—The kidneys may be congested or surcharged with blood, the congestion being of two kinds, *acute* and *passive.* Acute congestion of the kidney is sudden in its development, is attended with fever, suppression of secretion, pain, sense of weight in the loins, and, in very bad cases, with dropsy, or dropsy and coma. Acute congestion is usually brought on by sudden suppression of the action of the skin, as by lying down to sleep on damp ground, or by the action of some poisons, such as belladonna or alcohol. It also accompanies other forms of disease, as scarlet fever and malarial fevers. Passive congestion is slower and less severe in its manifestation. It is sometimes a sequel of acute congestion, and it is liable to recur in those who have once suffered from it.

Hæmaturia.—A term applied to the passage of blood from the kidney by the urinary canal. It is rather a symptom of congestion, or of mechanical injury to the kidney, or of some foreign growth in the structure, or of ulceration, than a disease of itself.

Nephritis, inflammation, and suppuration.—The kidney may be the seat of inflammation and of subsequent suppuration, *suppurative nephritis.* The affection may be of the simple inflammatory form, following upon extreme congestion, or upon irritation from some foreign body within the organ ; it may also be secondary to other acute affections, as pyæmia. The secondary form is the most common of the two. When the inflammation, however induced, extends to the pelvis of the kidney,—the little pouch from which the duct of the kidney called the ureter proceeds,—the term *pyelitis* is used, in the nomenclature, to define the condition of disease that has been set up.

All these inflammatory states of the kidney are of grave moment. They are attended, generally, with much fever, suppression of secretion, and often with dropsy. When suppuration

takes place the fever assumes the hectic character, and pus or matter may be excreted with the urine.

Hypertrophy and atrophy.—The kidney is sometimes much enlarged or hypertrophied. The enlargement may be uniform throughout, and simply owing to the increase of the natural structure as a result of excess of function. Or the enlargement may be due to effused material into the connective tissue. *Atrophy* or wasting of the kidney is a condition arising from two or three causes. It may accompany general wasting from privation or exhausting diseases: it may arise from failure of nervous supply: or, it may take place from deprivation of blood to the kidney, either through pressure exerted on the organ itself or from obstruction in the arterial blood-vessels.

Hypertrophy of the kidney of the simple form is usually attended with an increased flow of urine or diuresis. Atrophy is attended with a decrease of the renal excretion, and when from this or other cause the decrease is carried to arrest of flow of the excretion there is said to be suppression, or *ischuria renalis.*

Degenerations of the Kidney. Bright's Disease. Albuminuria.

The most important, because the most frequent, organic diseases of the kidney are those included under the head of Bright's disease, so called from the circumstance that the late distinguished Dr. Richard Bright first recognized the affections and made them known. The College authorities define these diseases as "several forms of acute and chronic disease of the kidney, usually associated with albumen in the urine, and frequently with dropsy, and with various secondary diseases resulting from determination of the blood."

Varieties of Bright's Disease.

There are several varieties now recognized of Bright's disease, which resolve, however, into two great divisions, the acute and chronic.

Acute Bright's disease, called also *acute albuminuria*, *acute desquamative nephritis*, or *acute renal dropsy*, is a disease in which the kidney becomes greatly enlarged and vascular, with its minute convoluted tubes into which the urine is primarily secreted filled with epithelium. The epithelial scales, in the form

of casts of the renal tubes, are voided by the urine, together with albumen and sometimes with blood. The obstruction to the flow of urine and the interference with the function of the kidney give rise to the most serious general symptoms. There is fever followed quickly by dropsy, and, in extreme instances, by coma and death. Acute Bright's disease is a rather common complication of scarlet fever, and is one of the dangers most to be dreaded in that disease. It is also produced by sudden and extreme chills, and by excessive use of alcohol.

Chronic Bright's disease is either a continuation of the acute affection, or is slowly developed without the occurrence of active symptoms. It is connected with further and permanent changes in the structure of the kidney, giving rise to three subdivisions of the chronic affections called granular, fatty and lardaceous kidney.

Granular kidney, called also contracted granular kidney, chronic desquamative nephritis, or gouty kidney, is a form of the disease coming on, usually, in persons of middle age, and especially in those of gouty habit. It is attended with albumen in the urine. The kidney is granular, firm, rough, hard, and generally contracted, its membranous capsule adhering closely to it.

Fatty kidney is a condition in which the organ is white and mottled. The secreting cells are granular and contain fatty or oily deposits.

Lardaceous kidney, known also as amyloid or waxy kidney, is a condition in which the organ is, as a general rule, enlarged, and presents on its surface a waxy appearance. This change seems to commence in the vascular structure of the organ, in the minute tufts of arteries that yield the blood from which the urine is secreted. The affection is often connected with fatty and amyloid changes in other parts of the body, as the liver, and it is, like them, associated not unfrequently with pulmonary consumption, and, specially, with syphilitic degeneration.

In addition to these degenerative changes the kidney is subject to *deposit of fibrine* within its structure. It is sometimes the seat of *cancer*, of *non-malignant tumors*, of *cysts*, of *parasitic developments*, and of *tubercle*.

The mechanical diseases of the kidney are:

Hydronephrosis.—"Dilatation of the pelvis of the organ, or of the glandular structure, into one or more cysts, by retained secretion."

Calculus.—Stone in the kidney, usually in the pelvis, or in the tube leading from the kidney to the bladder, the ureter. It is a very painful affection, causing often faintness and vomiting during the passage of the calculus.

Movable kidney.—A condition in which the kidney is, as it were, dislocated from its natural position and unfixed.

Diseases of the Bladder.

The bladder, a membranous pouch or bag for temporarily holding renal secretion, is made up of three coats or layers; a serous layer on its outer side, which may easily be stripped off the dead bladder, and which is derived from the peritoneum; a middle muscular layer of involuntary muscular fibres which surround the organ, and by their contraction empty it; an inner or lining mucous coat, which secretes a thin mucus. The bladder is subjected to many diseases.

Cystitis. Catarrh of the bladder. Vesical catarrh.—A condition in which the mucous surface of the bladder is in a state of extreme irritation, or is actually inflamed. The disease is acute or chronic. In the acute form it is attended with pain, fever, and frequent discharge from the bladder of ordinary secretion, containing, after a time, mucus. In the chronic form of the disease the feverish and other acute symptoms are modified, but the excretion of mucus and the irritation continues.

Ulceration and suppuration.—Under long-continued irritation of the mucous surface of the bladder the mucous membrane may undergo ulceration at one or more points. This change is attended with extreme pain, and often with discharge of blood as well as mucus. When the discharge of mucus contains pus or matter in large quantities, with febrile disturbance, suppuration of the bladder is said to be present. In rare instances the bladder may undergo *sloughing* or actual decomposition.

Fistula of the bladder.—From inflammatory mischief affecting it or its surrounding parts, the bladder may have in it an opening or fistula extending from it into other cavities. Four fistulous openings of this kind may occur from disease: (*a*) *Vesico-intestinal fistula*, in which the opening is from the bladder into the intestine. (*b*) *Recto-vesical fistula*, where the opening is from the bladder into the lower or straight intestine. (*c*) *Utero-vesical*

fistula, where, in the female, the opening is from the bladder into the uterus or womb. (*d*) *Vesico-vaginal fistula*, where, in the female, the opening is from the bladder into the vagina.

Hypertrophy.—The coats of the bladder are sometimes very much enlarged in cases where there is great obstruction to the escape of the urinary secretion. The muscular coat is the part which is most commonly hypertrophied. I have recorded an instance in which the walls of the bladder were nearly an inch in thickness from muscular hypertrophy.

Distention.—The bladder may be distended, the distention causing it to be sacculated or pouched, bulged out in parts, from the giving way of a portion of the coats. It may be actually ruptured. Long retention of the urine is the commonest cause of these accidents.

Mechanical accidents.—The bladder may be subjected to mechanical accidents, as *inversion*, *extroversion*, and *hernia*. It may contain foreign bodies accidentally passed into it. The most frequent mechanical mischief that happens to it is the deposit within it of calculus or stone.

Calculus. Stone in the Bladder.

This well-known affection is due to deposit from the urine of one or other of the more solid constituents. There is not always a direct deposit, for sometimes a foreign substance forms the nucleus of the calculus. There are twelve kinds of calculus of the bladder recognized in the nomenclature of disease. These are placed in the following order. 1. Uric acid. 2. Urate of ammonia. 3. Uric or Xanthic oxide. 4. Oxalate of lime. 5. Cystic oxide. 6. Phosphate of lime. 7. Triple phosphate, phosphate of ammonia and magnesia. 8. Fusible. 9. Carbonate of lime. 10. Fibrinous. 11. Urostealith. 12. Blood calculus.

The uric acid calculus, the triple phosphate, and the oxalate of lime which once was called the mulberry calculus because of its likeness to a mulberry-stone, are perhaps the most common kinds of calculus of the bladder. The first of the three, uric acid, is usually oval, fawn-colored, hard, and constructed in layers; the second, triple phosphate, is rough, firm, and drab-colored; the third, oxalate of lime, is rough, hard, and red, like a mulberry-stone.

Calculus of the bladder is more common in men than in

women, and affects residents of certain parts of the country more than those of other parts. It depends greatly on habit of body for its formation, and is very much favored by the use of alcoholic drinks, especially of malted liquors. The affection is attended with irritation and pain ; sense of retained secretion within the bladder ; and often, when the calculus is large, with discharge of mucus in the secretion. When the formations are minute and distinct, the escape of small calculi may occur, with much pain. Calculus of the bladder is now a remediable affection under surgical skill.

Foreign growths of the bladder.—The bladder is sometimes the seat of simple or non-malignant tumors ; of cancer ; and of a tumor called "villous," involving the mucous membrane.

Muscular affections.—The muscular coat of the bladder may be the seat of disease. We have already seen that it may be hypertrophied. It may also suffer from *paralysis*, *irritability*, and *spasm*. When the muscular coat is paralyzed there is what is called *retention* of urine, from the want of expulsive power. When the muscular coat is irritable the urine has to be voided too frequently, and there is what is known as *incontinence* of urine.

Diseases of the Prostate Gland.

In the male subject there exists in the front of the neck of the bladder a gland of the size of a Spanish nut, called the prostate. The gland has not one common duct, but has sixteen or seventeen small ducts, which terminate in the urethra, the passage leading from the neck of the bladder. The gland is the seat of several diseases, including :—*inflammation*, acute and chronic ; *ulceration ; abscess ; atrophy ; tumors*, non-malignant and cancerous ; *calculus ; cysts ;* and, *tubercle.* The most frequent forms of disease affecting the prostate are *chronic enlargement*, which may be simple or malignant ; and *calculus*, which occasionally becomes of large size, and is only removable by surgical skill.

Diseases of the Urethral Passage.

The urethra, or tube, leading from the bladder to the outlet from the body, is the seat of several diseases, especially in the male subject. It is subject to inflammation, *urethritis*, which may be simple, or gonorrhœal. It is subject to *ulceration*, the result

of preceding inflammatory disease; to *urinary abscess;* to *extravasation of urine;* to *fistula;* to *calculus*, or stone lodged or impacted in it, from which it may suffer severe laceration and injury; and to *impaction* of other foreign bodies. The most persistent disease of the urethra is, however, *stricture*, a result, in the great majority of instances, of specific or gonorrhœal inflammation. In stricture the passage is narrowed, so that the urine is passed with difficulty, and in worst cases is stopped altogether until relief is obtained from the surgeon. There are four kinds of stricture. *Organic*, where the stricture is caused by organic deposit and growth; *traumatic*, where it has been caused by a wound; *spasmodic*, where it is the result of spasm of the muscular fibres surrounding the canal; and *inflammatory*, where it is the result of existing inflammation within the canal.

Diseases of the Reproductive Glands and Organs.

The reproductive organs include in the male subject the testes and their parts; the spermatic cord; a serous membrane, which consists of two layers, investing and reflected, forming a true membranous sac, the tunica vaginalis; and an external pouch of skin, the scrotum. In the female subject they include the ovaries; the uterus or womb; and the Fallopian tubes.

Diseases special to the Male Subject.

Diseases of the testes.—The testes are seats of inflammation, *orchitis*, which may be acute or chronic, and which in the acute form is attended with extreme pain, fever, and often with faintness; of inflammation of the convolutions of the excreting ducts of the gland, the epididymis, *epididymitis;* of *abscess;* and of *hernia*. These glands may also be the seats of malignant disease; of simple tumor; of cystic disease; of wasting or *atrophy;* of *neuralgia;* and of the weakness of function known as *spermatorrhœa*.

The tunica vaginalis, or investing serous membrane of the gland, is subject to inflammation; to extravasation of blood into the tunic, *hæmatocele;* and to dropsy or *hydrocele*, in which watery or serous fluid accumulates, in large quantity, in the serous sac, and greatly distends both it and the scrotum. Of hydrocele there are three varieties: the *congenital*, where the dropsy is from

birth; the *infantile*, where it occurs in infancy; and the *encysted*, where it comes on in later years. Hydrocele is a disease very amenable to surgical skill.

The spermatic cord, composed of an investing membrane, of the spermatic artery derived from the abdominal aorta, of returning veins, and of the excreting duct of the gland, the *vas deferens*, in its course from the gland toward the abdominal cavity on each side of the body, may be the seat of *hydrocele*, or dropsy, encysted, or diffuse; and of *varicocele*, or enlargement of the veins, with a varicose or knotted condition, and distention of them from enclosed blood. The cord is sometimes the seat of tumors, simple or malignant, and of the painful nervous affection known as neuralgia.

The scrotum or cutaneous pouch containing the glands may be subjected to *sloughing;* to swelling or *œdema;* to *elephantiasis;* to *non-malignant growth;* and to *cancer.* In the days when youths were made to ascend chimneys as sweeps, epithelial cancer of the scrotum was commonly developed in them, and was called *chimney-sweeper's cancer.*

Diseases special to the Female Subject.

Diseases of the ovaries.—The two glands of the female, called the ovaries, situated in the lower part of the abdomen on each side, and each enclosed in a layer of peritoneum at the back of the broad ligaments of the womb, are the seats of several forms of disease. The ovary itself is a very vascular structure, with a cellular net-work enclosed in three layers of membrane, called the capsule. The inner of these layers of the capsule is finely vascular; the middle thick and fibrous; the outer, derived from the peritoneum, thin and serous. In the cellular structure of the ovary are a number of small vesicular bodies, called the Graafian vesicles or ovisacs, which contain an albuminous fluid, many granules, and the body, which becomes impregnated in impregnation, called the ovum.

The ovaries are liable to become the seats of *inflammation*, which in the acute form is attended with severe pain and fever; of *abscess;* of *hemorrhage;* of *hypertrophy* and *atrophy;* of *cancer;* of *fibrous tumor;* of *cysts;* of *parasitic* growths; of *complex cystic tumor*, *colloid*, and *cystosarcoma;* of *hernia;* of *dislocation;* and of *encysted dropsy.*

Dropsy of the Ovary.—The most remarkable and most common disease of the ovaries is the last-named above, encysted dropsy, commonly known as ovarian disease, or ovarian dropsy. In this affection one or more ovarian cysts form, and become enlarged and filled with fluid. The fluid accumulates until the cyst may increase to over a foot in diameter, and may attain a weight of many pounds. The fluid in the cyst is sometimes quite clear and watery; in other instances it is thick and albuminous; in other instances still, it is gelatinous and almost solid. The tendency is for the ovarian cyst to increase until it fills the abdominal cavity, and to destroy life by the pressure it exerts on the breathing, the circulating, and digestive organs. Of late years, an operation, invented by Dr. McDonnell of Kentucky, and greatly advanced by Mr. T. Spencer Wells and other eminent surgeons, for the removal of these ovarian tumors, has been attended with the most magnificent success, from seventy to ninety per cent. of cases which would have ended fatally without the aid of the operation being now recoverable. No surgical operation discovered or invented in the present century, or indeed in any century, has been so remarkable as this operation which is called ovariotomy.

Diseases of the Uterus or Womb.—The uterus or womb is the receptacle in which the ovum is received after impregnation, and is the pouch in which the body is developed from its embryonic state into that in which it is presented at its birth. The uterus is not connected permanently with the ovaries by a duct, in the same way as the bladder is connected with the kidney; but it is indirectly connected by means of two ducts, called the Fallopian tubes, which emerge from it one on each side at the upper angle of the fundus or body of the organ. These little tubes, discovered by Gabriel Fallopius about the year 1559, extend from the uterus laterally on each side, for a length of nearly five inches, along the upper border of the broad supporting ligament of the womb. They are made up of a mucous lining, which is continuous from the uterus; of a coat of circular muscular fibres lying outside the mucous coat; and of a serous outside coat derived from the peritoneum. The tubes expand at their free ends in a trumpet-shaped fashion, and terminate in two or three fringed or fimbriated projections, which are ordinarily free, but which under excitation grasp the ovary, and enable the ovum to escape into the tube, and pass through the tube into the uterus.

The uterus itself is made up of three coats: of a lining of mucous membrane, the inner coat; of a circular and longitudinal layer of involuntary muscles, the middle coat; and of an investing serous membrane from the peritoneum, the outer coat. The organ is pear-shaped, and in the unimpregnated state in the adult person is about the size of a moderate-sized pear. The upper part of it is called the fundus or body; the smaller and lower, the cervix or neck; and the opening of the neck, the os or mouth. The uterus is the seat of many diseases.

Catarrh or Leucorrhœa.—The mucous lining of the uterus is subject to catarrh or excessive secretion from its surface, the secretion passing away as a passive white discharge, leucorrhœa.

Inflammation.—The uterus is subject to inflammation, which may be of the simple kind, involving chiefly the mucous lining, or may extend more deeply into the muscular coat, and may be of a special form, called *granular* inflammation. The inflammation may also end in formation of matter or pus, which when diffuse is called *suppurative*, and when encysted or confined is called abscess.

Ulceration.—The organ is often the seat of that destruction of surface, called ulceration, brought on either by long-continued irritation, by congestion, or by inflammation. The neck or cervix of the uterus at its os or mouth is the part most commonly affected with ulceration. In rare cases the uterus is the seat of the special ulceration called *rodent ulcer*.

Abrasion.—The mucous surface of the uterus may be subjected to abrasion, by which the surface is suddenly removed or destroyed at some point. The affection usually ends in ulceration, and heals after the manner of a healing ulcer.

Mechanical affections.—The uterus may be the seat of mechanical diseases or affections, of which the principal ones are:—*Utero-vesical fistula*,—a fistulous opening from the uterus into the bladder; *stricture of the orifice of the cervix; stricture of the canal of the cervix; occlusion of the cervix; occlusion of the canal.* It is liable to seven displacements—(*a*) *Anteversion*, tilting or turning forwards; (*b*) *Retroversion*, tilting or turning backwards; (*c*) *Anteflexion*, bending forwards; (*d*) *Retroflexion*, bending backwards; (*e*) *Inversion*, or turning inside out of the organ, an accident occasionally connected with childbirth; (*f*) *Prolapsus*, falling or descent of the organ from its natural place; (*g*) *Hernia* or rupture.

Hypertrophy and atrophy.—The uterus may undergo hypertrophy or enlargement, either from actual increase of its muscular fibres, or from deposit in its cellular connecting structure. The cervix, or neck, may also become enlarged or elongated. The uterus may undergo atrophy or wasting of its structure, and so become reduced to an extremely small size.

Tumors and Growths of the Uterus—Fibroid Disease.—The uterus may be the seat of various growths, malignant and simple. It is liable to become affected with scirrhus cancer, medullary cancer, and epithelial cancer. It is the seat, in some cases, of a non-malignant but troublesome cellular or fibrous growth, springing from its inner surface by a neck or pellicle, called *polypus;* and of a growth in its own substance, known as *fibroid disease* or *enlargement.* In this last-named form of disease, fibroid enlargement, the uterus may become of a very large size and a source of great discomfort, but the affection is not necessarily fatal, and it sometimes, according to my experience, permits those who suffer from it to attain to old age.

Diseases of the Appendages of the Uterus.—The Fallopian tubes may be the seats of inflammation, dropsy, stricture, occlusion, hernia, dislocation, and of foreign growths, simple and cancerous. The broad ligaments of the uterus, the folds or duplications of the peritoneum by which the organ is supported in its place, are subject to two inflammations,—*pelvic peritonitis* and *pelvic cellulitis;* to abscess; to cyst and *pelvic hæmatocele;* and to extravasation of blood into the cellular or connecting structure.

The vagina or membranous tubular sheath, which extends from the os or mouth of the uterus to the external surface of the body, and which is lined with mucous membrane continuously with the uterus, is the seat of several diseases, viz., catarrh; inflammation; abscess; cicatrix or band; hernia; cancerous growths, usually epithelial; and non-malignant growths, including polypus. It is subject to laceration; and to three kinds of fistula. (*a*) Vaginal fistula. (*b*) Vesico-vaginal,—fistula into the bladder. (*c*) Recto-vaginal,—fistula into the lower bowel. By surgical manipulation carried in these days to great perfection, nearly all cases of these kinds of fistula are curable, and an untold amount of suffering, common in former times, is saved.

Functional Diseases of the Uterus—Irregular Menstruation.—The uterus, after the age of puberty, fourteen years, and up to

the age of forty-five to fifty years, is the seat of a periodical monthly change, called menstruation, during which it discharges, for a period of three to five days, a fluid called the menstrual, composed of uncoagulated blood, of mucous or epithelial cells from the mucous surface, and of *débris* of a membrane formed within the uterus, and which has, in the unimpregnated uterus, to be cast off. During childbearing this menstrual function is suspended, the membrane cast off in menstruation being required as a receptive membrane for the ovum when it enters the uterine cavity; but at other times the function is necessary for the perfectly healthy condition of the woman during the periods of her life that have been quoted above.

The phenomena of menstruation are sometimes changed, in various ways, from what is natural; and such derangements are expressed under the following heads:—

Amenorrhœa. Absent menstruation.—A condition in which the function fails from one of four causes. (*a*) Original defective formation. (*b*) Want of development at puberty. (*c*) Mechanical obstruction. (*d*) Temporary suppression of function.

Scanty menstruation.—A condition in which the function is performed, but in which the amount of fluid thrown off is scanty and usually deficient in color.

Vicarious menstruation.—A condition in which menstruation occurs, as it were, in place of, or vicariously for, some other discharge or function.

Dysmenorrhœa. Painful menstruation.—A condition in which the act is carried out with great pain, the pain being referred to the lower part of the body, and being reflected severely to the back and loins. This state is often accompanied with faintness, nausea, inability to take food, mental excitement hysterical in character, and physical depression.

Menorrhagia. Excessive menstruation.—A condition in which the function is attended with great loss of fluid. The loss may be extreme at the natural period, or it may, by frequent recurrence, be a repetition of smaller losses. Some, therefore, speak of the first kind as acute, and of the second as chronic menorrhagia.

Hemorrhage.—A condition in which there is direct loss of blood from the uterus, uterine hemorrhage. This is most commonly connected with childbirth, and is one of the serious com-

plications of that act. But it may occur under other circumstances, as in connection with acute or chronic menorrhagia, with a purpuric or extremely fluid state of the blood generally, with ulceration of the mucous surface of the uterus, or with polypi or other tumors, malignant or non-malignant, developed in the uterine cavity.

Diseases of the Breast Glands.

The female breast, the gland yielding the secretion of milk in the nursing woman, is liable to many diseases. It may be subjected to disease at times when it is taking on the active function of secretion, and at other times when it is yielding no secretion.

Inflammation and its consequences.—The breast is sometimes the seat of inflammation, which, when secretion is commencing in it, may be acute or chronic. The inflammation is attended with much pain and fever, and ends often in the formation of abscess, commonly called *milk abscess*, which, as a rule, either breaks or has to be incised by the surgeon. In healing there is sometimes left a small opening which will not close, and which is called a *sinus*.

Excess and deficiency of secretion of milk.—In rare instances the secretion of milk is so profuse that the loss is a cause of great debility. To this state of disease the term *Galactorrhœa* is applied. In other cases, and much more frequently, the milk is deficient in quantity and in quality. This is called *deficiency of milk*, and is one of the most common conditions of disease in poor and ill-fed nursing mothers of all communities.

Disease of the nipple.—The nipple of the breast is liable to two painful affections, *chapped nipple* and *ulcerated*. It is in some instances drawn in so closely as to be on a level with the body of the gland. This is called *depressed nipple*.

Hypertrophy and atrophy.—The breast-gland may be subjected to enlargement or hypertrophy, either from excessive growth of the natural parts, or from deposit in the connective structure. The gland is subjected, more frequently, to wasting, or atrophy, in which it shrinks into very small dimensions, leaving the once distended skin in loose folds and wrinkles, marked with white spots and lines. Excessive action from many and prolonged nursings, with impoverishment of food, or improper supply of food, are the usual causes leading to this atrophy.

Growths or Tumors of the Breast.—The female breast is the seat of many foreign growths, non-malignant and malignant. The non-malignant are—(*a*) *Fibrous tumor*, a firm and very painful growth immediately under the skin—"painful subcutaneous tumor." (*b*) *Fibro-plastic tumor*, a deeper seated growth, more fixed, of slower development, and less painful. (*c*) *Fatty tumor*, a growth of fat enclosed in its own membranes, often in lobules, slow of development, rather loose, and not painful. (*d*) *Osseous tumor*, a very hard tumor of calcareous or bony structure. (*e*) *Enchondroma* or cartilaginous tumor, very firm to the touch. (*f*) *Adenoid*, a tumor like the gland itself in structure, and of slow growth; called also "chronic mammary tumor." (*g*) *Vascular tumor*, a tumor consisting of vascular structure, but not of rapid development. (*h*) *Cysto-sarcoma*, a tumor made up of cystic growths, with firm inter-deposited plastic matter; called also "complex cystic tumor." (*i*) Simple cystic growths. (*j*) Parasitic cystic developments.

Cancer and Colloid of the Breast.—The mammary gland, or breast, may be the seat of malignant disease, and is perhaps the organ of the body that is most subjected to this affection in women. The breast may be attacked by *epithelial*, by *medullary*, or by *hard* cancer,—*scirrhus*. Of these the scirrhus form is most frequently met with, and ordinarily commences as a small swelling in the gland, which at first may feel loose and give little pain, but which grows larger, harder, and more painful. In time it causes retraction of the nipple; and, allowed to run its own course, it continues to increase, involving surrounding parts, until the skin breaks through, and a large ulcerated surface is produced, which shows no tendency to contract or heal. The disease, up to this day, is mortal, for although by surgical operation the local growth can be removed, there is ordinarily a recurrence of the affection either in the other breast, in the glands under the arm, or in some other gland or organ of the body.

Colloid.—The breast is sometimes the seat of the gelatinous tumor called colloid. The growth may attain a very large size, and develop with great rapidity. It is doubtful whether it be malignant. From the breast of a patient under my care, the late Sir William Ferguson removed, in the year 1852, a large colloid, after which event the lady lived over twenty-five years, and died of senile decay.

Other affections.—The breast, lastly, is subject to a peculiar neuralgia, called *mastodynia;* and to excessive sensitiveness, *hyperæsthesia.*

The rudimentary mammary gland or breast in the male is subject occasionally to disease. I have seen it once the seat of cancer, *scirrhus.* It may be the seat of inflammation, hypertrophy, simple tumor, and cystic growth. It has been known to secrete milk.

Diseases of the Ductless Glands.

The ductless glands that demand our attention are three in number. The thyroid, or the gland in the fore part of the neck. The spleen. The suprarenal capsules.

Diseases of the Thyroid Gland.

Inflammation.—The thyroid gland may be the seat of inflammation, either acute or chronic in character. The affection is rare as an uncomplicated condition of disease.

Goître.—The disease known as goître, also known in this country as "full throat" and "Derbyshire neck," is a disease of the thyroid gland. It is often present in connection with the condition called cretinism, and in certain districts it is specially frequent, as if from some purely local cause. The College reporters define it as "enlargement of the thyroid gland, endemic in certain mountainous districts, but not limited to them." The enlargement is sometimes due to hypertrophy of the natural tissues of the gland. In other cases it is due to a cystic enlargement. It often attains a very large size, and in worst examples it interferes with the circulation of the blood through the neck, or even with the passage of food through the œsophagus.

Exophthalmic goître or bronchocele.—This term is now used to express "an enlargement with vascular turgescence of the thyroid gland, accompanied by protrusion of the eyeballs, anæmia, and palpitation." It is the most distressing form of goître, and in some mountainous districts in tropical regions is, comparatively, a frequent affection. It would seem to be hereditary in character.

Pulsating bronchocele.—An enlargement of the thyroid gland accompanied with arterial pulsation.

The thyroid gland is occasionally the seat of cancer, usually of the scirrhus variety.

Diseases of the Spleen.

The spleen, a large vascular organ, lying in the abdominal cavity, beneath the liver, on the left side, is a ductless gland, enclosed in an elastic coat, and invested by the peritoneum. The uses of the spleen are as yet not fully understood. Important duties in the animal economy have been assigned to it, and yet, to my own knowledge, the experimental fact remains that an animal can live what appears to be a perfectly healthy life without the spleen. The spleen was considered by the older physiologists to be a compensating organ for the blood of the digestive system. When the digestive organs do not require blood, when they are not at work, the spleen, it was imagined, is the elastic spongy reservoir for blood; but when the digestive organs are at work then the spleen gives up its blood to them. This mechanical view is not abandoned, though there is now added to it the belief that in the spleen the corpuscles of the blood, called the white corpuscles, are produced, and that in it the red corpuscles are disintegrated or broken up. These latter views are chiefly derived from the diseased conditions of the spleen that have been discovered after death.

The spleen is the seat of several diseases.

Splenitis.—Inflammation of the spleen. This affection is not often distinct or uncomplicated in the human subject. Inflammation of the spleen in man is most commonly the result of pyæmic inflammation, with abscess as a further development of the inflammatory condition. In this way the spleen may become indirectly the seat of inflammatory disease, and is often so affected during acute diseases of other organs.

Fibrinous deposit.—After some general inflammatory conditions of the body the spleen may be the seat of extensive deposit of fibrine from the blood. The deposit may be diffused in patches, or, as I have once seen, in lines or bars, through the structure of the gland. The deposit may undergo partial organization.

Congestion.—The spleen is naturally liable to undergo vascular congestion, being essentially a vascular organ. It is probable that we never experience a chill but that an excess of blood is thrown upon the spleen. The congestion is most fully developed in the disease known as intermittent fever or ague, with its paroxysms of coldness, heat, and perspiration. In this affection, when

it is long-continued, the spleen gains an enormous size from repeated and prolonged congestions, and is left permanently enlarged, forming what is, expressively but vulgarly, called *ague cake.*

Hypertrophy.—The spleen may undergo enlargement from hypertrophy of its natural parts, in which state its functional activity is believed to be increased. This condition is so frequently connected with the blood disease in which the white corpuscles are increased, *leucocythæmia*, that this blood affection is thought to be due to super-activity of the spleen, with consequent increase of the white, and, possibly, an unnatural disintegration of the red, corpuscles.

Amyloid disease.—A diseased state of the spleen, in which it undergoes degeneration into a lardaceous or waxy condition. The degeneration is connected, perhaps in every case, with a similar form of change in some other organ or organs of the body, such as the liver or kidney.

Hodgkin's disease.—A disease first described by the late Dr. Hodgkin, in which the spleen is the seat of a white deposit, and in which the lymphatic glands of the body are greatly enlarged. The disease, which has been laboriously studied and written on by Dr. Wilks as a distinct organic affection, is attended by general symptoms of anæmia or bloodlessness, with a tendency to dropsy or anasarca.

Other affections.—The spleen may be the seat of cancer,—I have once seen it the seat of medullary cancer,—of colloid, of tubercle, and of parasitic growths. It may be, mechanically, torn or ruptured.

Disease of the Suprarenal Capsules.

The two ductless glands placed upon the kidneys, and called the suprarenal capsules, have long been a puzzle to the physiologist. Their use is yet undiscovered, but, since the days of the late Dr. Addison, they have been brought under close observation from the fact that he connected with disease of their structure a series of general bodily symptoms, which have since been designated after him as "Addison's disease."

Melasma Addisoni.—This disease, called commonly "Addison's disease," is attended by anæmia, great debility, occasional syncope, and exhaustion. But the most marked feature of the

affection is the peculiar color of the skin. The skin assumes a bronzed or smoked appearance, which may intensify until the person affected may scarcely be recognizable from a mulatto. The affection is fatal, and is attended always with some changes of varied character,—atrophic, fibroid, tubercular, cancerous, or inflammatory,—in the suprarenal capsules. It is still doubtful whether these changes are the cause of the symptoms of bronzed skin disease or the results of a general condition of disease, in which the suprarenal capsules are invariably but secondarily involved. Whichever may, ultimately, be found to be the fact,—and there is a wide field for research in the investigation of the changes in other organs connected with the disease,—the original and perceptive labors of Addison cannot well be over-estimated.

CHAPTER VIII.

DISEASES OF THE MUSCULAR SYSTEM, TENDONS, AND APPENDAGES.

The diseases of the muscular system were but little understood as structural diseases until the microscope became an instrument of research in the hands of the physician, and even in the present day the subject has not been studied with the successful zeal that has been devoted to other inquiries on the seats and causes of disease. It will be remembered that there are three sets of muscular organs: the red striped voluntary muscles, the muscles which move the body under the direction of the will; the red striped involuntary muscles, the muscles, like the heart, which move without the direction of the will; and the unstriped white muscles which surround the automatically acting organs, and which are purely involuntary in the direct sense of the term. The structural diseases of the voluntary and involuntary red striped muscular organs have been best studied, while those of the involuntary are open to much further investigation. It must be understood, therefore, that the diseases referred to as affecting the muscular system, relate, with few exceptions, to the red or striped muscular organs.

Diseases of Muscular Structure.

Inflammation and abscess.—The muscles may be the seat of inflammation, but whether that is connected only with the fibrous or membranous sheaths in which the fleshy muscular elements are enveloped, or whether it is in the muscular elements, is not as yet fully determined. Pure and simple inflammation of muscle is, in fact, very rare as a disease uncomplicated by rheumatic affection, or by pyæmic fever. When the inflammation does occur in a muscle it is attended with dull pain, inability to move the muscle, swelling, and fever. As a result, matter or pus may form in the muscle, producing *abscess.*

Hypertrophy.—The natural structure of a muscle may become enlarged or hypertrophied, a result, as a general rule, of excessive work of the muscle. This is commonly illustrated in the enlargement of the muscles of the arm of the blacksmith and of the leg of the opera-dancer. It is met with also in the heart, as we have already seen.

Atrophy.—Atrophy of the muscles is a condition common to all the extremely exhausting diseases, and is the chief cause of the weakness which characterizes them. In pulmonary consumption and other diseases of the wasting class, the muscles are reduced until they almost become like cords. In many instances special muscles, or sets of muscles, are atrophied from want of use, and in paralysis of the limbs this form of muscular failure is of common occurrence. Atrophy of the heart is sometimes ascribed as a cause of death.

Progressive muscular atrophy.—A condition in which the muscular structure begins to waste in some part of the body, as the muscles of the upper limb, and in which the wasting continues until the whole of the voluntary system is affected in a similar manner. The disease is sometimes called wasting palsy. Strictly speaking, it is a nervous disease, and is truly a paralysis dependent upon inflammatory or degenerative change in the gray matter of the spinal cord.

Paralysis.—The muscles are subjected to the varied forms of paralysis which have been before us already, under the heads of infantile paralysis, scrivener's palsy, diphtheritic paralysis, general paralysis, paralysis agitans, and so on. It is not, however, considered that these are diseases of the muscular structures; though, from their continuance, the muscular system may undergo wasting and other organic changes, owing to impaired nutrition. The paralyses are of nervous origin, and are considered as belonging to diseases of the nervous system.

Convulsion, Spasm, and Tetanus.—The muscles may be convulsed, or may be thrown into spasm or tetanus, in which conditions they are the seats of serious functional disorder, and may, indeed, be physically injured. The conditions, however, are not dependent on the muscles, but are due to primary nervous derangement to which the muscular fibre responds. These affections are therefore also classed under diseases of the nervous system.

Exhaustion.—A muscle, or set of muscles, may be exhausted, as from a blow, or from excessive work or strain, and for a time may be unable to act freely in response to nervous influence. This is called exhaustion of the muscle.

Foreign growths.—The muscles may be the seat of foreign growths. These include, simple non-malignant and erectile non-malignant tumors, colloid tumors, cysts, cystic growths, and cancer. It cannot be said that any of these are common affections of the muscular substance.

Parasitic disease—Trichinosis.—The muscular organs may be the seats of parasitic developments, and they are specially the seats of the parasite called trichina spiralis, the larval state of a nematode worm. The parasite infests the muscular structure sometimes in large numbers, and remains embedded in the substance in points or spots, looking like small cells or beads. When the parasites first enter the muscular substance they create pain, which is often mistaken for muscular rheumatism. As the larvæ become encysted the acute pain is reduced, and then there is, or may be, a prolonged period of impairment of function, the cause of which may not be discovered until after death. The trichinosis parasite in man is derived from his taking as food the muscular flesh of lower animals affected with the parasitic growth. Received into the stomach, the larvæ very quickly develop into maturity, causing much pain and disturbance in the alimentary system. The female trichinæ giving forth their embryos in abundance, the embryos migrate along the connective tissue into the structure of the muscular organs, where they become encysted, as described above.

Degenerations of Muscular Organs.

The muscles, including the heart, are seats of degenerative changes, two of which are specially important.

Fatty degeneration.—The muscular tissue in this form of degeneration is transformed, more or less, into a fatty condition, the truly muscular elements being replaced by fatty or oily particles. In this state the muscle fails to respond to the nervous stimulus, and though the structure may remain of the same size, or may even increase in bulk, it is incapacitated for active work. The heart is the muscle most frequently affected by this degeneration.

Osseous degeneration.—A condition in which the muscular

structure is converted into calcareous or bony matter. The heart may become—as I have once myself seen it—transformed, in part, into firm bone. Osseous change is attended with little acute pain, but with permanent destruction of function of muscle in the part involved in the change.

Diseases from deposits.—The muscles may become the seats of special deposits, tubercular and syphilitic, and it is probable that the involuntary muscular fibres are often the seats of syphilitic deposit, by which their action is greatly impaired, and from which impairment two diseases of the blood-vessels, namely, dilatation and aneurism, have frequent origin.

The muscles are subject to *rupture* or *tear*. The rupture may be in the structure itself. It is more commonly in the muscular sheaths. It may be caused by excessive strain or by a blow on a healthy muscle. It may occur under ordinary movement in a muscle affected or weakened by disease.

Diseases of Tendons.

The tendinous terminations of muscles called commonly the *sinews* are themselves devoid of contraction. They are, as it were, the membranous sheaths of the true muscular tissue condensed into one homogeneous structure at the ends of the muscular bodies. They are composed of fibrous tissue, and are enclosed in an investing web or sheath. They are the passive parts of muscle, and form the attachments of muscles to bone, by means of which the muscles pull or exert their power to move the bones. The tendons are the seats of several diseases.

Inflammation—Thecal abscess.—The tendons are often the seat of inflammation, as a result of wounds in which they are involved. A common form of inflammation of tendon is that known in the finger, called thecal abscess or *whitlow*, in which matter forms within the sheath of the tendon, causing a most painful local inflammation accompanied with irritation and fever. The tendons are sometimes involved in rheumatic inflammation.

Sprain.—When a tendon, or a tendinous expansion, or fascia, is subject to severe stretch, or to tear, or to displacement, a sprain is produced. Sprain is a common injury, and is usually attended with external swelling, pain, and difficulty of movement in the part, lasting for several days. The tendinous expansions or fascial coverings of muscles are occasionally torn across, in places like

the calf of the leg; severe injury to motion occurs from such tearings, together with great pain, swelling, sometimes ecchymosis or effusion of blood, and usually some after fever. This painful accident is called *rupture of the tendinous fascia.*

Adhesion.—Tendons, as a result of inflammation, may become adherent one to the other, or to surrounding parts. The effect of the adhesion is to produce more or less derangement of motion from the muscles connected with the tendon or tendons implicated.

Contraction of Tendons.

Tendons are liable to contraction, by which the parts they are connected with may be shortened or otherwise distorted. The contractions are sometimes congenital and sometimes the result of disease or accident after birth. The most common contractions are those affecting the foot and causing the various deformities called generally club-foot.

Talipes or Club-foot.

There are several kinds of club-foot, talipes, some of which have received different names according to the character of the deformity. The principal of these are as follow.

Talipes varus.—This is the most common form of club-foot, and may be a congenital affection. The heel is drawn up; the inner side of the foot is drawn up and the toes are turned inwards. The sufferer learns to walk, in this case, on the outside of the foot.

Talipes valgus.—A condition the opposite to the above, in which the heel is raised, the outer side of the foot is turned up, and the sufferer walks on the inner side of the foot and inner ankle.

Talipes equinus.—A contraction in which the heel is drawn straight up, so that the sufferer walks on the toes, or on the toes and a small part of the surface of the foot.

Talipes calcaneus.—A contraction in which the toes are drawn up, and the sufferer walks on the heel bone,—the calcaneum, or os calcis.

Talipes calcaneo-varus.—A contraction in which the toes and inner side of the foot are drawn up, so that the patient walks on the heel and outer side of the foot.

Talipes equino-valgus.—A contraction in which the heel and outer side of the foot are drawn up, so that the patient walks on

the toes and inner side of the foot. This is called also "*flat-foot.*"

Club-hand and contracted fascia of the Hand.

The hand, from contraction of tendons, is subject to deformities which are not sufficiently definite in character to admit of classification like those of the foot. The deformity called contracted fascia is one in which the palm of the hand is contracted, or in which the fingers are contracted on the palm. The contraction may be in the fascia or in the flexor tendons, or in both fascia and tendons. It is most usually the result of accident, as from strain, or from lifting very hot substances such as heated metal. In some persons of gouty or gouty rheumatic constitution the contraction may come on in middle life without the action of any apparent exciting cause.

Wry neck.—The College authorities classify wry neck as a disease of the tendons. It is a condition which is owing to a contraction of the oblique muscle of the neck, the *sterno cleido mastoideus*, the muscle which stretches across on each side from the mastoid portion of the temporal bone, near to the ear, to the junction of the sternum, or breastbone, with the inner end of the clavicle, or collar-bone. The contraction of this muscle, which the artist knows so well, causes the head to be drawn on to one shoulder, while the face looks towards the other shoulder. The sternal end of this muscle is tendinous, and the contraction may be in the tendon; but it may also arise from spasm of the muscle itself. Wry neck is most common in the young who are of mixed strumous and rheumatic constitution. It usually follows attacks of feverish affections in these. The spasmodic form may be purely hysterical in character, and in one of the worst examples of wry neck I ever knew, which was of this origin, recovery occurred instantly from a start or fright, although the contraction had existed five years.

All these distortions from contraction of tendons are now, owing to the excellent labors of Dr. Little, Mr. William Adams and other surgeons, greatly amenable to surgical skill.

Diseases of the Appendages of the Muscular System.

Connected with the muscular system are small bodies called bursæ. These are small pouches or sacs of synovial membrane,

filled with synovial fluid, and placed near to joints to prevent the friction of parts gliding the one over the other. Thus there is a bursa over the wrist-joint, another over the knee-pan, and so on for other similar parts. The bursæ are subject to diseases, which are classified in the following order.

Enlarged bursa of the patella.—A condition in which the bursa of the patella, or knee-pan, is enlarged and distended with synovial fluid. The disease is brought on by frequent kneeling on a hard substance, and is so commonly presented by the housemaid, who kneels to scrub floors, that it has obtained the name of *housemaid's knee.*

Wrist bursa is another name given to an enlarged bursa at the back of the wrist. It is a common disease among pianoforte players in their early life.

Bursal tumor.—An enlargement of a bursa, ending in solidification, so as to form a hard and often painful tumor.

Bursal abscess.—A condition in which matter, or pus, forms within a bursa. It is the result of inflammation, and is a continuation of an acute enlargement of the bursal sac. I have known it induced by a blow ignorantly inflicted on an enlarged bursa, with the object of dispersing it.

Bunion.—The affection called bunion is an enlargement or thickening of the bursa over the large or metatarsal joint of the great toe. It is usually produced by the friction of a badly fitting boot or shoe.

Ganglion.—A painful swelling, resembling a bursa, formed by an enlarged cyst, or a newly developed cyst of synovial membrane in the sheath of a tendon, or of a tendinous expanse. The swelling, if it be near to a nerve or a sensitive structure, is very painful. It may attain a large size. At first it is soft, and the presence of fluid within it can be detected; but after a time it becomes firm and solid. It is commonly produced by undue pressure and friction, or by a violent strain. When it is present in the hand, involving the sheaths of the flexor tendons, and causing one large double swelling in the palm of the hand, and another on the wrist above the ligament which runs transversely across the wrist, the affection is called in the nomenclature, "*diffused palmar ganglion.*"

CHAPTER IX.

DISEASES OF THE OSSEOUS SYSTEM OR SKELETON, INCLUDING THE TEETH.

THE bones on their exterior are covered with a strong sensitive membrane, the periosteum, from which, as the researches of M. Ollier so ably proved, the bony structure is secreted, so that periosteum being in contact with many vital tissues, new bone is producible. In the joints the bones are covered with synovial membrane, the glistening structure which is seen when a joint is laid open and which secretes the glairy synovial fluid, by which the surfaces of the joints are lubricated and saved from friction. Within some of the bones, within the shafts of the long bones particularly, there is also a substance made up of fatty tissue, called the medulla or marrow, which supports the blood-vessels by which the bone is fed, and also, according to a recent view, plays an important part in the formation of the red corpuscles of the blood.

In considering the diseases which have their seat in the skeleton we have, therefore, to include diseases of the bone proper, of the periosteum, of the synovial membrane, and of the medulla or marrow.

It is well to recall, in relation to the diseases of bone, that the bony structure is made up of two parts, of an organic, and of an earthy or inorganic part. The organic matter is the gelatine which can be separated by the process of boiling bones. The earthy is that which is left as powder or ash when a bone is burned. The animal, or organic matter, makes up about thirty-three per cent. of bone, the earthy sixty-seven per cent. Of the earthy matter fifty-five per cent. is composed of calcium phosphate, the remaining twelve per cent. is made up of magnesian phosphate and calcium carbonate, with a little calcium fluoride. The earthy substance gives strength and solidity to the bone; the animal matter holds the earthy together, acts as a cement, and

gives to bones a certain measure of resiliency. This is important to keep in mind in relation to disease. If the earthy matter be deficient, the bone will bend; if the animal matter be in excess, the bone will too easily fracture or break. The bones are connected together by strong fibrous bands or ligaments, which interlace and form elaborate and important structures, while in many of the joints there are interposing structures of cartilage.

To the skeleton we have to add, as part of it, the teeth, which, placed in what is called the alveolar or socket portion of the jaw-bones, are thirty-two in the second or complete set; viz., four incisor; two canine, four bicuspid, and six molar in each jaw; and twenty in the first set or teeth of infancy, milk teeth; viz., four incisors, two canines, and four molars in each jaw. These structures have to be taken into the study of the diseases of the osseous system.

The diseases of the bones and teeth fill, as may be expected, a long list in the local history of disease; and yet, after all, they are not extremely complicated. In the nomenclature forty diseases are assigned to the skeleton; thirty are connected with the teeth, and seventeen are connected with the process of development of the teeth.

Diseases of Bone and Periosteum.

Ostitis.—Inflammation of bone; a disease very rare in its uncomplicated form. When it occurs it is, usually, in the young who are of feeble and strumous constitution. Even in them it is, I believe, always induced by some external influence, such as a cold, an injury, or one of the epidemic diseases. It occurs, as a rule, in the large long bones, and is attended with much pain, fever, local swelling, and it may be redness of the skin over the affected bone.

Periostitis.—Inflammation of the periosteum, or periostitis. This, like inflammation of the bone structure, is rarely seen except in feeble persons of scrofulous taint. It is attended with signs similar to those which are noticed in ostitis, but the pain is more acute. When the inflammation is very diffuse, and matter forms beneath the membrane, *acute periosteal abscess* or *diffuse periostitis* are the terms used to express the diseased condition. When again this ends in death of the bone structure, without death of

the periosteum, *acute necrosis*,—death of bone,—is said to have taken place.

Nodes.—Persons who have contracted the specific disease syphilis, are subject to a subacute inflammation of the periosteum, usually in the long bones, and most frequently in the leg-bone, the tibia, from which there is produced a long-shaped and painful swelling, called a *node.* As a general rule, the swelling passes away with the resolution of the constitutional affection.

Caries.—A condition practically of ulceration of bone, in which, after inflammation, the bony substance becomes porous, and, in the acute stage, filled with a reddish glairy exudation. The bone is dead, and, left to become dry, assumes, literally, a worm-eaten appearance. It is a cause of great irritation and often of ulceration, attended with offensive discharge. Caries may be the result of injury of bone, of inflammation, or of death of the periosteum.

Necrosis.—Necrosis also means a death of bone and arises, like caries, from injury or from inflammation. But in necrosis the periosteum, which may remain intact, throws out a plastic fluid, and from that new bone is gradually formed, which joining with sound bone above and below causes separation of the dead bone in what is called a sequestrum or residue. The new bone thus formed may fulfil all the purposes of natural bone. The late Professor Laurie of Glasgow was wont, very happily, to define caries as death of bone, and necrosis as "death of bone with regeneration."

Mollities Ossium.—A condition of disease in which the bone softens, and at the same time becomes brittle. The bone loses its earthy constituents, and the animal structure of which it is composed is softened, it may be almost to a pultaceous state, so that the bones easily bend and break. Or the osseous matter may be left porous, so that the bone is extremely brittle, and breaks from very slight causes. The affection is most common in women, and the pelvic bones are the most frequent seat of it. It is not necessarily fatal, and it may last for many years. I have known it to occur in the male subject, though no doubt that is not a common event. It is connected always with some constitutional condition, usually syphilitic or tuberculous in character.

An allied disease to mollities ossium is often met with in the insane, and when it is present very slight injuries cause fractures

of the bones or the ribs. I knew an instance of this kind in which ten ribs were found to have been fractured after death. In these cases the earthy matter is deficient. I found in a bone taken, after death, from a man who had suffered from the affection, that the amount of earthy matter was, actually, under nine per cent. Yet that bone, which had been fractured at least twice, had undergone two attempts at repair from effused periosteal lymph and new ossification.

Rickets.—A disease classed by the College as one belonging to the general diseases of constitutional type. Rickets is connected with deficiency of earthy substance in the bones, and the bones, therefore, unable to support the weight of the body, bend under it and give rise to curvature of limbs and spine, which may, and often do, become permanent deformities. Rickets is due to constitutional taint; to the bringing up of children in bad air; and, above all, to the feeding of children on foods deficient in the earthy salts that are necessary for the natural construction of bone.

Spontaneous fracture.—Spontaneous fracture of bone is fracture occurring from some simple accident or natural act of the body. In one of my medical friends it occurred in a rib, from coughing. The bone in these cases is usually diseased and brittle from deficiency of animal structure.

Foreign growths of bone.—The bony structure may be the seat of several forms of the non-malignant growths, with the nature of which we are now familiar. The growths of simple character classified as specially connected with bone are *fibrous and fibro-cystic tumors; myeloid*, a reddish tumor commencing usually in the ends of bones; *cartilaginous*, called also *enchondroma;* and *osseous*, called *exostosis.* Of the last named, exostosis, there are three varieties; the *ivory exostosis*, in which the enlargement is hard and smooth like ivory; the *cancellated*, in which the enlargement is porous or cancellated; and the *diffused*, in which the enlargement is spread over a considerable surface of bone.

The bony structure may also, as we have seen, be the seat of cancer, *osteoid.* This cancer commencing in bone may be of extremely rapid growth.

The bony structure may, again, be the seat of cystic developments and of parasitic growths.

Hypertrophy and atrophy.—The whole or part of a bone may become generally enlarged, or hypertrophied, from uniform in-

crease of its structure; but it is more frequently the seat of atrophy or wasting, in which it is generally reduced in size and rendered weak and fragile, the external firmer surface becoming thinned and deficient in power of resistance. To this state the term *fragility* or *fragilitas ossium* has been applied.

Constitutional changes in bone.—The great constitutional taints, syphilis and scrofula, are common causes of disease in bone, and the terms syphilitic and scrofulous disease of the osseous system are in common use. As a rule these terms refer to one or other of the forms of disease already named, and as developed in persons who are under the taint of the constitutional affections, syphilis or scrofula.

Diseases of the Joints.

Synovitis.—Inflammation of the synovial or lining membrane of the joints is the first disease named on the list of affections of the joints. This inflammation, attended usually with severe pain, and when the joint is a large one, like the knee-joint, attended also with much constitutional derangement and fever, is divided into two kinds, the acute and the chronic. The acute form is often the result of injury, which may be very slight in character; it runs a course of from ten to twelve days, causing much swelling, and severe suffering under the slightest movement, in the joint. The chronic form is, as a rule, a continuation of the acute, but it is sometimes assumed without precedence of acute symptoms. Chronic inflammation of the synovial membrane may lead to softening and to what is technically designated "pulpy degeneration" of the synovial membrane.

The inflammation of the synovial structure of joints may assume the rheumatic, the scrofulous, and the syphilitic character in persons who are constitutionally under the influence of these taints. Rheumatic and chronic rheumatic inflammation of the synovial membrane is the most common of all the varieties of synovitis.

Ulceration of cartilage.—The cartilages of the joints may, from long-continued inflammation, and some think from irritation without active inflammation, become the seat of ulceration by which the joint is disabled and rendered excessively painful. This ulceration, when it is not the result of injury, is commonly connected with rheumatic or scrofulous taint.

Abscess.—Abscess within a joint, though it may occur from injury or from extension of inflammation from neighboring parts, is exceedingly rare in a healthy constitution. In scrofulous persons it is more common, and in scrofulous children abscess or formation of matter within a synovial pouch is by no means uncommon. The disease, in them, is called scrofulous disease of the joint, and is typified in an affection of the hip-joint known as *morbus coxæ.*

Ankylosis.—The stiffness of joints which follows upon inflammation, ulceration, abscess, or other injury, and which leaves the joint firm or immovable, so that it cannot be moved by the person to whom it belongs, nor even by another person without its being broken, is called ankylosis. Ankylosis may give rise to various kinds of deformity according to the position in which the fixture of the joint, from adhesion of its surfaces, has taken place.

Dropsy of the joints.—An accumulation of synovial or watery fluid within a joint is called a dropsy of the joint. It is usually the result of injury, and is attended with slow and large swelling of the joint, and for a time with acute pain. It subsides, usually, from natural absorption of the exuded fluid, but in less favorable instances it demands assistance from surgical art.

Diseases of the cartilages.—In addition to the ulceration of cartilage, to which reference has already been made, the cartilages of joints are subject to other forms of disease; viz. (*a*) to *degeneration*, involving the articular surfaces of the bones; (*b*) to separation from their natural position within joints, so that they become movable, and by movement out of their place give rise to intense suffering, *loose cartilage;* and, (*c*) to displacement at their articulating surfaces, *displacement of articular cartilage*, by which they cause deformity of the joint, and thereby of the limb or part with which they are connected.

Relaxation of ligaments.—The ligaments or strong but delicate fibrous bands which hold the joints in position are liable to relaxation under sprain or violence from without, or from swelling or tension derived from within the joint. The relaxed ligament becomes unable to hold the joint in its proper position, and is then readily dislocated from slight causes. This is well illustrated in those instances where the shoulder-joint is very easily displaced in consequence of the ligaments having become unnaturally relaxed, weak and incapable.

Deformities of the knee-joint.—The knee is subject to two marked deformities, which are called respectively *bow-leg* or *out-knee*, and, *knock-knee*. In the first of these affections the knees are widely separated from each other, and cannot be brought together, so that the legs are bowed. The deformity is common amongst those who are accustomed to carry heavy weights from the shoulders, like water and milk-bearers who carry the yoke. In these instances it is sometimes the case that the thigh-bones and leg-bones are somewhat bent; but the chief deformity is in the knee-joint, the heads of the femur and tibia being depressed on the inner side, so as to throw the limb out of the straight line. In knock-knee, on the other hand, the knees come close together on the inner side, so that the femur on each side bends inwards, and the tibula and fibula leg-bones bend outwards from the knee, the feet standing far apart. Knock-knee is more common in women than in men. The deformity may, I think, become hereditary.

The joints are sometimes the seats of *tumors* which may be either non-malignant or cancerous. The joints are not infrequently the seats of *neuralgiac pain*.

Diseases of the Spine.

The bony column called the spine is subject to a series of diseases which, owing to their importance, have been particularly enumerated. The ligaments and cartilages of the spine are subject to *ulceration;* the bones are subject to *necrosis*, *caries*, and *ankylosis*. The bones may also be involved in surrounding *abscess* in the lumbar or loin region. They may be subject to rheumatic affection, to cancer, and to tumors of a simple character.

We have already seen in the section of the local diseases of the nervous system that the spine is subject to a particular malformation called *Spina bifida,—Hydrorachitis*.

Spinal Curvatures.

The spine is subject to several varieties of distortions called commonly curvatures. The following four are named in the official catalogue.

Angular deformity. Kyphosis.—A deformity in which there is bending of the spine as a result of caries, or of absorption of the bodies of the vertebra,—those thick, solid masses of the ver-

tebral structure which lie upon each other and form the solid part of the spinal column. This deformity occurs usually in scrofulous children or adults, and is one of the worst forms of spinal disease. It is always painful, and from the pressure which may ensue, it is sometimes a cause of palsy of parts fed with nerves derived from the portion of the spine involved in the disease.

Lateral curvature. Skoliosis.—The spine is subject to bending or curvature on one or other side of the body, a condition which may be inherited or acquired. It is often acquired in the young by making them stand for long periods in one position while they are growing; or by the habit of standing on one foot or of bending over to one side. The curvature shows itself first in the process of becoming high-shouldered on one side, and, finally, in a complete distortion, if it go on, of curve or bending over, the column itself being visibly bowed or bent from the pelvis, on which it rests, over to the side to which it has been directed. The disease, less severe and less dangerous than angular curvature, is a defect causing weakness of the spine, and occasionally much weakness of the limbs and body.

Anterior curvature. Lordosis.—Under this head is defined a curvature in which the spine is bent forward or anteriorly, but not at an angle. Anterior curvature is the frequent result of making the young lean forward for long periods when they are sitting at work, as at writing. It is sometimes acquired by the habit of stooping, and, in the poor, I have known it caused by the pressure of weights carried on the head. Mr. Liebreich has shown that anterior spinal curvature is often concurrent with short-sightedness, the two diseased conditions being produced by the same cause, viz., the bending forward of the body, and the long continuance of that unnatural position.

Rickety curvature.—The deformity of the spine known as rickety curvature is not, necessarily, of one curve, but sometimes of two or more curves. It commonly accompanies rickets of other parts of the body. It affects feeble rachitic children, who have been improperly nourished. It forms, almost invariably, a part of the disease rachitis.

The spinal column is subject to *neuralgia*, *rheumatic affection of its membranes*, and various kinds of mechanical injuries.

Diseases of the Jaws.

The jaws, including in the upper jaw the cavity called the antrum, are subject to fibrous, myeloid, osseous, cartilaginous, and vascular tumors. They are also subject to hypertrophy, to necrosis, to caries, to cysts, and to cancer. In rare instances they are subject to adhesion by cicatrix.

Abscess in the Antrum.—The antrum, or cavity in the body of each upper jaw-bone, is subject to inflammation, followed by the formation of matter,—*abscess* of the antrum. This abscess may give rise to much enlargement of the bone and of the cheek, and may be incapable of cure until brought under surgical skill.

Polypus and Tumors in the Antrum.—The antrum may be the seat of polypoid growth, and such growth may extend into the cavity of the nose, giving rise to swelling and great deformity of the face, which nothing but surgical operation can reach as a means of cure. The antrum may be the seat of tumor, malignant or non-malignant, under the growth of which the cavity is distended and the bony walls of it thinned and destroyed. It is occasionally the seat of foreign bodies.

Diseases of the Teeth.

The diseases affecting the teeth are divided into—(1) Diseases which affect the true dental tissues; the enamel or crown; the dentine or internal bone; and the crusta petrosa or cementum, the outer bony structure of the tooth that lies within the jaw, the fang. (2) Diseases which affect the dental pulp, a sensitive structure within the tooth made up of arteries, veins, nerves, and connective substance. (3) Diseases of the periosteum or fibrous structure surrounding the fang, and connecting it with its socket or alveolus. (4) Diseases of the alveolus or socket in which the tooth is inserted. (5) Specific diseases affecting the periosteum of the teeth, the alveolus, or the gum. (6) Irregular development of the teeth; irregular dentition.

Diseases of the Structures of the Teeth.

Caries.—Caries of the teeth is a slow process of destruction or ulceration without any attempt at repair. It commences usually in the enamel or crown of the tooth, but it may commence

from inflammation affecting the dentine or supporting bony tubes of the enamel, and may extend from within the tooth outwards. In my *Medical History of Diseases of the Teeth*, published in 1860, I defined caries of the teeth as a slow disintegration of the hard structures, mainly of the enamel and dentine, by which a cavity in the tooth is produced from a process of destruction progressing in the dentine without replacement or development of new tissue. The definition thus given is sufficiently correct. The disease commences, as a rule, in the enamel, either from an accident or from defective condition of that structure. From thence the mischief soon passes to the dentine, the tubes of which support the enamel, and as that structure dies, from ulceration, the enamel gives way. The cavity, called in common language the decayed cavity of the tooth, is thus produced.

Necrosis.—Necrosis means partial or complete death of the structure of the tooth, the death commencing either from failure of nutrition from the vascular nervous structure—"pulp"—in the cavity of the tooth, or from the periosteum. The necrosed tooth becomes dark and dead in the parts affected.

Exostosis.—Exostosis of a tooth is an enlargement of the true bony part of the organ, the cementum of the fang. The enlargement is sometimes general, at other times it takes the form of a tumor or swelling at the extreme point of the fang, where it may make almost a socket joint within the alveolus, producing a tooth it is very difficult to extract. In exostosis the surrounding membrane or periosteum is thickened, and the disease is always attended with severe pain, the worst form of toothache.

Absorption.—Absorption of the teeth is a gradual removal of structure, owing to impoverishment of nutrition, usually from disease of the external nutritive membrane, the periosteum. The absorption is rarely confined to the tooth alone, it is commonly combined with absorption of the alveolus or socket. As a result the tooth recedes from the jaw, and, becoming loose, is detached from its position. Absorption is most common in persons of advanced life. It occurs, however, occasionally, in the young, when the body is improperly nourished, or is suffering under some extreme constitutional taint. Partial absorption of the enamel of the teeth, causing indentations to the surface, may follow the occurrence of some of the eruptive cutaneous diseases of the young. The jagged, saw-like appearance on the cutting edges of the

teeth, which is seen in some persons who are constitutionally weak, is, strictly speaking, an irregular form of absorption of the hard or enamelled structure.

Diseases of the Dental Pulp.

The pulp of the tooth is said to be subject to three forms of disease—*irritation*, *inflammation*, and *ulceration*. These may, in truth, be considered as the course of one diseased condition proceeding from irritation to inflammation on to destruction or ulceration. At the same time, irritation may stand alone, and may not proceed to inflammation. Irritation of the pulp is rarely, if ever, a disease of itself; it commonly is connected with some other form of disease, such as rheumatic affection or injury, or commencing caries, or exostosis. It is always attended, in the acute stages, with severe pain, and after complete destruction, from ulceration, it is followed by death of the internal bony tooth tissue.

Gangrene of the tooth is a disease specified in the nomenclature. It is of the rarest occurrence, and when present is a rapid decomposition of the tooth, attended with moist softening and offensive odor. I have seen it once, markedly, in a person suffering from scurvy, who was also constitutionally affected with the specific disease, syphilis.

Diseases of the Dental Periosteum.

The dental periosteum or peri-dental membrane which envelops the bony part or fang of the tooth and connects it with the alveolus, is subject to a change of texture called *granulation;* to a change into hardness called *calcification;* and to *inflammation.*

Gum-boil.—The disease commonly known as gum-boil is an acute inflammation involving the periosteum. The affection, extremely painful, is resolved at last, in most cases, by the formation and escape of matter, or pus, between the fang of the tooth and the alveolus.

Chronic Thickening.—The periosteum after inflammation, acute or chronic, is liable to undergo chronic thickening, accompanied with swelling and hardness of the gum, and often with extreme pain in the tooth itself, which nothing but extraction permanently removes.

Rheumatic Inflammation.—In persons of rheumatic consti-

tution the periosteum of the tooth is subject to rheumatic inflammation, followed by thickening of the membrane and continued irritation. Most of the examples of thickening of the peri-dental membrane are, according to my experience, the result of rheumatic inflammation.

Diseases of the Alveolus.

The bony structure which encloses a tooth, and which is called the alveolus or socket process, is subject to the same classes of diseases as the jaw-bones themselves, of which, in fact, it forms a part. It is liable to suffer from *inflammation*, *caries*, *necrosis*, *exostosis*, *absorption*, and *cysts*. The alveolus is sometimes fractured in the operation of extraction of a tooth.

Errors in Dentition.

In the process of cutting the teeth, and in the development of the teeth,—whether the temporary or the permanent sets,—there are certain errors or irregularities which are noticed by our standard authority as forms of disease. These irregularities are: (*a*) An irregularity in the time of eruption of the temporary or permanent teeth, the irregularity consisting, usually, in delay in the time of eruption: (*b*) irregularity in the position of the temporary or permanent teeth, as when one tooth overlaps or displaces another: (*c*) irregularity in the number of the temporary or permanent teeth: (*d*) irregularity in the form of the teeth of either set: (*e*) development of unnatural structures in the enamel, the dentine, or the cementum.

In addition to these irregularities there are also added changes in the jaws and teeth. (*a*) Unnatural development of the sockets of the teeth in relation to size or form: (*b*) defective growth of the lower jaw: (*c*) mechanical injuries of the sockets and periosteum, including fracture and hemorrhage: (*d*) mechanical injuries to the teeth themselves, such as fracture, dislocation, and, a not uncommon cause of caries, friction from pressure.

CHAPTER X.

DISEASES OF THE SKIN AND MEMBRANOUS SYSTEM.

THE membranous system includes, as we have already learned: (*a*) the covering of the body called the *skin;* (*b*) the lining of the external cavities of the bronchial surface, of the mouth, of the whole length of the alimentary canal, and of the bladder, called the *mucous membrane;* (*c*) the membranes which envelop the vital organs, as the brain, the heart, the lungs, the intestines, called *fibrous* and *serous membranes;* (*d*) the strong membranes which envelop the bones and line the joints, called *periosteal* and *synovial membranes;* (*e*) the connective or sponge-like web of membrane which connects all the organs of the body together, called *connective or areolar membrane*, or, more commonly, cellular or connective tissue.

We have studied the diseases affecting the mucous membranes, the serous membranes, the periosteal and the synovial membranes, in the descriptions of the diseases of the different organs and parts with which those membranes are connected. We have only, therefore, now to study the diseases of the skin and of the cellular or connective tissue.

DISEASES OF THE SKIN.

The older medical authorities have been accustomed to divide diseases affecting the skin into nine orders, according to the external appearances presented to observation. By this method they described the following forms of cutaneous disease:—

(*a*) The Papulæ or pimples.

(*b*) The Squamæ, or scaly diseases.

(*c*) The Exanthems, flower-like or eruptive diseases.

(*d*) The Bullæ, blisters or blebs.

(*e*) The Pustulæ, or pustular diseases, in which pus or matter is thrown out in points.

(*f*) The Vesiculæ, or vesicular diseases, in which small vesicles or water bladders are formed.

(*g*) The Tuberculæ, or tubercular diseases, in which hard swellings or tubercles are formed.

(*h*) The Maculæ or spots, spotted diseases of the skin.

(*i*) The Ulcerous diseases, in which there is break of continuity of the skin with loss of structure.

The authorities of the Royal College avoid this classification, and very properly throw out of their list the exanthematous eruptions, like those of measles or scarlet fever, which are merely signs of general diseases. I shall, as usual, follow the College order, without, however, ignoring the classification given above, which, in many respects, is practical, useful, and distinctive.

Erythema.

Under the term erythema is described redness of the skin of an acute form. It is commonly defined as "a nearly continuous redness of a portion of the skin, attended with some disorder of the constitution, but not contagious." Sir Erasmus Wilson gives another definition. He defines the especial characteristic of erythematous affections as "redness without exfoliation or desquamation (scaling), or other secondary change."

There are six varieties of erythema recorded in the official list. 1. *Erythema læve*, redness of a dark character, surrounding an old ulcer or large vein, or spreading over a limb affected with anasarca or dropsy. 2. *Erythema fugax*, the redness that suddenly suffuses the face and neck of nervous hysterical subjects. 3. *Erythema marginatum*, redness marginated or edged. 4. *Erythema papulatum*, redness very bright and in patches, with many red points or pimples, appearing on the limbs or the breast. The papulæ or pimples are usually small, and dispersed on the red surface, though distinguishable to the touch as well as the sight; but sometimes they are in clusters, and sometimes they themselves extend or increase from their edges. The affection is commonly acute and transient, lasting only a few days, but it may become chronic. 5. *Erythema tuberculatum*, a variety in which, instead of mere pimples, small raised swellings or tumors are present. Persons affected with tubercular disease of the lungs are supposed to be most liable to this erythema, which generally comes on with some fever and constitutional disturbance. 6. *Ery-*

thema nodosum, erythema in raised patches of round or oblong form, occurring on the inner side of the limbs, and looking like a spotted eruption. This variety of the disease is always attended, according to my experience of it, by dyspepsia and slight fever. It often recurs in the same person, and may last a week or ten days.

Intertrigo.

The term intertrigo is applied to define the red cutaneous eruption and soreness, resembling erythema, and by some classified with it, which is brought on by the rubbing of two surfaces of the skin together in their folds. The affection is apt to occur in persons who are very corpulent, and in fat infants, especially when they are not kept wholesomely dry and clean. The redness may pass into actual abrasion of the skin from the friction, followed by watery exudation.

Roseola.

Roseola is a word used to define a rose-colored rash on the skin which is evanescent in character and attended with slight fever. The rash may be in patches or general, and may resemble that of measles or scarlet fever, for both of which it is often mistaken by the unskilled. The disease is not accompanied by soreness of throat, is not contagious, and only lasts a few days. It commonly comes on from indigestion, and in children is often connected with derangement of the stomach from errors in diet, such, for instance, as are incident to children's parties. It may be acute or chronic, and it is said to present four varieties:—1. *Roseola æstiva*, summer roseola; 2. *Roseola autumnalis*, autumnal roseola; 3. *Roseola symptomatica*, indicative or symptomatic; 4. *Roseola annulata*, annular like, or in form of a ring.

Urticaria. Nettle-rash.

The disease urticaria, though commonly called a skin disease, is in truth an affection of a general kind, attended with eruption on the skin as one particular symptom. The disease may be acute or chronic, and it is prone to recur in certain persons under conditions favorable to its development. The eruption on the skin is erythematous, with raised surfaces in wheals, or in round white points resembling closely the sting of the nettle. The skin

is often raised around the white point. The eruption is attended with much heat and irritation. When it attacks the palms of the hands or soles of the feet the burning sensation may be of the acutest kind, and, in the worst forms of the affection, excruciating. There is always some constitutional disturbance and dyspepsia, but there may be no fever, and the malady is certainly not contagious.

Urticaria is stated to appear under six different varieties:—1. *Urticaria febrilis*, in which case it is accompanied with fever. 2. *Urticaria evanida*, a short or evanescent form. 3. *Urticaria perstans*, a lingering or persistent variety. 4. *Urticaria conferta*, in which the points of eruption are close or crowded together, confluent. 5. *Urticaria subcutanea*, where the skin is much inflamed and raised from beneath. 6. *Urticaria tuberculata*, where the erythematous surface is affected with small hard swellings or tubercles; a rare form of the disease.

Urticaria seems to be almost invariably connected with derangement of the digestive system. It is often accompanied with much disturbance in the stomach and bowels, and is relieved most readily and determinately by purgation. It often follows the taking of certain articles of food or drink, and is therefore fairly considered as due to intestinal irritation in most instances, and to peculiar action of certain foods on particular constitutions. In persons liable to it I have seen it follow the taking of lobster, mullet, mussels, pork, oranges, and whitebait. I have known one death occur during urticaria. It was caused by the mucous membrane of the larynx becoming implicated in the eruption, with suffocation as the result.

Pellagra.

The term pellagra is employed to describe a disease of southern Europe which is also known under other names, as the leprosy of the Asturias and as the elephantiasis of the Asturias. It is met with in Italy, in Spain, and in some parts of France. It commences as a slow cutaneous inflammation, not unlike erysipelas, and ends in hardening of the skin and accumulation of scales. The attack commonly comes on in the spring, goes through a distinct series of stages, and dies away in the following winter. It returns in a worse form the next spring, and still worse in the spring following. At last the skin is more or less covered with a

scaly eruption, thick and hard, resembling leprosy. As the local disease becomes more pronounced, various nervous symptoms appear, ending in paralysis and mental alienation. The disease attacks all classes of society, but chiefly the poor. It is not contagious and, in its early stages, is amenable to treatment.

Acrodynia and Asturian rose.

Acrodynia is a disease marked, as its name implies, by pain in the limbs, with changes both in sensibility and motion. It is attended with irritation of the conjunctival membrane of the eyes and of the surface of the skin, the skin becoming sometimes scaly and hard as in pellagra. During its course there is much disturbance of the nervous and digestive systems, and it is commonly of long duration. In almost all severe instances of it it leaves in its train some form of nervous disease.

Asturian rose is another cutaneous affection of southern Europe. It partakes of the character of an erythema, shading into pellagra, but is of a less formidable type.

The diseases included in the above descriptions would be placed by the older authorities as belonging to the order "exanthemata."

Prurigo.

The disease prurigo is a cutaneous eruption of papulæ or pimples, attended with an intolerable itching, which in very bad cases is so severe and tormenting as to cause even disturbance of the mind. In the first stages the pimples or papulæ, although raised from the surface and rough to the touch, are not changed in color from the natural skin; but, owing to the irritation and the scratching which is used to relieve it, the skin soon becomes dotted or lined with dark marks from bleeding. The disease is not contagious. It is often of long duration, and is usually connected with nervous depression and failure of nervous power.

Lichen.

Another pimply or papular eruption on the skin is called lichen. The pimples are raised, cone-like in shape, and red. They spread in large patches, and often extend over a considerable surface of skin. The affected parts are subject to severe

itching or pruritus, and scales are usually thrown off from them. The College reporters give five varieties of lichen. 1. *Lichen simplex*, the simple and most transient form. 2. *Lichen pilaris*, when the pimples include the roots of the hairs. 3. *Lichen circumscriptus*, where the eruption appears in large and fairly distinct patches. 4. *Lichen agrius*, a very troublesome lichen, appearing usually on the arms, the papulæ being close together, scaly and moist with, it may be, fissures and cracks in the skin surface. The disease not unfrequently attacks grocers and bakers, and from the irritation it produces is called "baker's or grocer's itch." 5. *Lichen tropicus*, an extensive eruption of lichen, accompanied by much prickly irritation and heat, from which circumstances it has obtained the name of "*prickly heat.*"

Strophylus. Tooth rash. Red gum.

In infancy, especially during the period of teething, the body of the child is liable to be affected with a red pimply or papular rash called strophylus. The affection is usually mild in character, and passes away when the irritation of cutting the tooth is over. There are said to be three varieties of strophylus: 1. *Strophylus intertinctus.* 2. *Strophylus confertus.* 3. *Strophylus candidus.* They are mere shades of the one eruption, and are all dependent on the same cause. The rash is usually slight and transient.

The diseases prurigo, lichen, strophylus are included in the old classification under the order "papulæ."

Pityriasis.

The cutaneous affection called pityriasis is commonly defined as a scaly eruption, in which the scales are distributed over the surface of the skin in irregular patches. The scales are often separated and reproduced, but they are dry scales. They do not form crusts, and they are not attended with cracks, sores, or excoriations. The College authorities describe one variety only of the disease, namely,—*pityriasis capitis*, pityriasis of the scalp, *dandriff*, which is often met with in infants, and sometimes in the aged.

There are, however, two other important varieties of the affection which deserve to be noted. 1. *Pityriasis rubra*, a form in which the scaly eruption is attended with great redness of the

skin, redness of the scales themselves, and separation of the scales in lines or layers which are very characteristic. This form of the disease is often combined with other severer cutaneous scaly eruptions, and the subjects of it are usually sufferers from nervous depression and debility. 2. *Pityriasis eburna*, a variety in which the scales thrown off are pure white and flat, like scales of bone or ivory.

The disease pityriasis may be induced by known agents acting on the body. When arsenic is taken internally for a long time in small and frequently repeated medicinal doses, pityriasis may be the result,—*pityriasis arsenicalis*. I have myself recently seen a sharp attack of the disease on the hands and arms of persons engaged in work which exposes the skin of those parts to the action of the bichromate of potassa. Autotype workers are exposed to this last-named accident unless great care be taken in their dealing with the bichromate solution which is used in their art. Another form of pityriasis, *pityriasis versicolor*, is now referred to parasitic affections, as synonymous with *Tinea versicolor*.

Psoriasis. Lepra Vulgaris.

At one time the cutaneous disease known as lepra vulgaris was assumed to be a distinct disease. It is now included, by our authority, under the head of psoriasis.

Psoriasis is a scaly eruption which may appear in separate rings or patches, each distinct from the other, the extension of each being from the circumference. This is the form of the disease which was known as lepra vulgaris, to distinguish the condition from that which occurs when the patches unite by extension, when the islands of scales—if I may be permitted the simile—blend into continents, a condition to which the word psoriasis was always applied. In truth, the nature of the eruption is, in both cases, practically the same. There is first some irritation, then eruption of scales which grow dense and white at the centre, and afterwards expansion of the eruption from its outer edge, which is red and occasionally slightly raised.

There are five varieties of Psoriasis:—1. *Psoriasis vulgaris*, or *lepra vulgaris*, the forms just described. 2. *Psoriasis guttata*, in which the scaly eruption is spread out, like drops, on the skin. 3. *Psoriasis diffusa*, in which a number of patches unite together

and lose by their union their original rounded form or outline. 4. *Psoriasis gyrata*, a modification of the foregoing, in which the patches, owing to irregular healing, assume an in and out, or gyrated appearance. 5. *Psoriasis inveterata*, a variety of the extremest kind, in which the scaly eruption invades the greater part of the body. The face, the palms of the hands, and the soles of the feet often escape, but not always. The incrusation of scales in this variety of psoriasis is dense. After a time the skin chaps and breaks, on which there is soreness, with exudation of fluid from the broken surface, intense irritation and itching, and great mental and physical exhaustion, lasting over many weeks or even months. I have never known the disease end fatally, but some authors state that they have. When the scales assume a dark appearance on a leaden-colored surface of the skin, the term *psoriasis nigricans* is used to express the modification.

Ichthyosis.

The disease *ichthyosis*, *fish-skin* disease, is an affection in which the cutaneous structure is thickened and firm, *Ichthyosis vera;* or dense and horny, *Ichthyosis cornea.* It is so commonly an affection existing from birth that some have looked upon it as purely constitutional, as neither allied to psoriasis nor other scaly eruptions, but as a cutaneous malformation rather than a cutaneous disease.

Ichthyosis, with the diseases pityriasis and psoriasis, belong to the old order of skin affections, "squamæ."

Miliaria.

In the course of some acute diseases of the febrile type there will sometimes appear on the skin a vesicular rash or eruption, to which the name of miliarial rash or eruption is applied. The vesicles are usually compared to millet seeds in respect to appearance, and may be spread or interspersed over the whole surface of the body.

There are two varieties:—1. *Miliaria sudamina*, where the vesicles are like drops of perspiration. 2. *Miliaria rubra*, where the vesicles are injected and inflamed.

Herpes.

Herpes is a cutaneous disease in which there is a vesicular eruption, comparatively transient in character, with the vesicles ranged together in clusters. The skin in the part affected is injected and inflamed, and at first the fluid filling the little vesicles is almost transparent. As the vesicle matures its contents thicken, and in the end the eruption passes away in scab-like scales.

There are four varieties of herpes named in the College list: —1. *Herpes phlyctenodes*, in which the eruption is variable in respect to its place on the surface of the body. 2. *Herpes circinatus*, where the eruption assumes a ring-like shape. 3. *Herpes iris*, in which the eruption takes the form of concentric rings. 4. *Herpes zoster*, commonly called *shingles*, in which the eruption breaks out in the lower part of the chest, about the middle of the body, and, in clusters of a bead-like kind, extends more or less round the trunk as a circumscribed zone two or three inches wide. Shingles or herpes zoster is a painful affection, and is attended with fever for two or three days, and often with pain which is described as rheumatic in character. It is apt to recur in the person who is subject to it, and it most commonly recurs in the months of spring. I have no doubt that it is hereditary. The vulgar notion that it proves fatal when the eruption completely encircles the body is without foundation, the disease not being fatal in its course unless it be complicated by some other and more serious affection. It seems to have a short period, one to two days, of incubation, and it runs a course of from five to seven days. Neither it nor any other of the herpetic affections are contagious.

Eczema.

Eczema is a most painful and obstinate vesicular affection of the skin. It is well-defined by Wilson as "*an inflammation of the skin attended with a breach of its surface.*" There is redness, swelling, elevation of the cuticle, and a vesicular eruption in a number of minute blisters. After the vesicles break there is a copious exudation of fluid, which itself acts like a blistering fluid, and keeps up the irritation. The exuded fluid forms into scabs and crusts, intermixed it may be with matter or pus, and sometimes with blood. The pain, burning, and itching are intense,

and when the affected surface is chapped and excoriated, the sensitiveness is intolerable.

There are four recognized varieties of eczema:—1. *Eczema simplex*, in which the disease is present in its simplest and mildest form. 2. *Eczema rubrum*, in which there is redness of surface or erythema, erythematous eczema. 3. *Eczema impetiginodes*, where the eczematous eruption is coupled with an eruption of small pustules called impetigo. 4. *Eczema chronicum*, an eczema in which the disease becomes chronic, with persistent inflammation, formation of crusts, and discharge.

Eczema is not contagious. It is hereditary, and is apt to recur in a person who has once suffered from it. It may or may not be accompanied by systemic signs of disease, and it is usually connected with nervous exhaustion and feebleness. It is now largely under the control of medical art.

Rupia.

Rupia is the name assigned to another vesicular cutaneous eruption. The vesicles are spread out in patches from which there exudes a fluid which forms a crust or scale, and has under it an ulcerated surface. The points of eruption are usually widely separated, and occur on various parts of the body.

There are three varieties of rupia:—1. *Rupia simplex*, in which the eruption is of the simplest and mildest form. 2. *Rupia prominens*, in which the scale that is formed is raised, in a conical shape, layer upon layer. 3. *Rupia escharotica*, in which there is an extension of irritation, as from a caustic or blister, with an offensive discharge. Rupia is usually due to constitutional specific disease, syphilis.

Rupia, eczema, herpes, and miliaria belong to the old order "vesiculæ" of cutaneous diseases. Two other affections, which have already been described in the chapter on diseases running a definite course, namely, varicella or chicken-pox, and vaccina or cow-pox, are often put under this same order.

Pemphigus or *Pompholyx.*

Pemphigus is an eruption of a blister or bleb, breaking out on the cutaneous surface without much, or it may be without any, erythema or preceding inflammation.

The College list names three varieties of Pemphigus:—1. *Pemphigus acutus*, where the outbreak is sudden and distinct, and in more than one part at the same time. 2. *Pemphigus solitarius*, where one blister is developed and passes away to be succeeded by another or by others. 3. *Pemphigus chronicus*, where the disease is long persistent. To these varieties the late Dr. Stokes added a fourth, or epidemic variety, to which he gave the name of *Pemphigus gangrenosus*. Pemphigus in its active form is attended with fever, and in the ill-fed young assumes, sometimes, an epidemic type; but it does not seem to be contagious.

If the blister which denotes pemphigus were to appear on an inflamed or erythematous surface of skin it would be said that the disease presented was erysipelas, a disease included in the chapter on diseases which run a definite course.

Erysipelas and pemphigus were formerly classed as cutaneous affections under the order "bullæ."

Impetigo.

Impetigo is a disease which is characterized by an eruption of a pustular character. In this respect it resembles small-pox, but differs, essentially, in that it is not contagious, and cannot even be communicated by inoculation. The pustules are small, and form light continuous scales or scabs. The disease differs also from small-pox in that it is not accompanied by severe fever. The eruption usually appears on the limbs.

There are two varieties of impetigo:—1. *Impetigo sparsa*, in which the points of eruption are distinct and apart. 2. *Impetigo confluens*, in which the pustules run into each other. The affection appears chiefly in the feeble, and is most frequently seen in children who have been badly fed.

Ecthyma.

Ecthyma, like impetigo, is a pustular eruption very similar to the eruption of benign or mild cases of small-pox, but the spots are widely apart, and are not necessarily attended with fever. The disease is not itself contagious, but it occasionally occurs during convalescence from the communicable diseases. The pustules

are larger than those in impetigo. Ecthyma appears most frequently in the feeble and impoverished.

The diseases impetigo and ecthyma were classified by the older authorities under the order "pustulæ."

Acne.

The eruption called acne consists of a number of small pointed and firm tubercles. It is a slow or chronic inflammation of the sebaceous follicles of the face, and sometimes of the breast and shoulders. After a time the small tubercles become surrounded with pus or matter at their bases, and when they have died away they often leave a scar.

There are said to be four varieties of acne:—1. *Acne punctata*, in which each tubercle is distinct, and, as it were, marked out. 2. *Acne indurata*, in which the swelling is indurated or hard. 3. *Acne rosacea*, a bad form of acne, occurring in persons of advanced life. It is seated, exclusively, on the nose, is attended with redness of the surface of the skin of the nose, and causes great disfigurement. The affection mostly afflicts persons who have indulged freely in alcoholic drinks, and connects itself with the enlargement of the blood-vessels which is so common a result of alcoholic disease. 4. *Acne strophulosa*, a form of acne attended with strophulous rash. In some cases of acne an acarian parasite, called by Owen the "Demodex folliculorum," is present in the affected follicle.

Sycosis. Mentagra.

Sycosis is an eruption of a tubercular character, affecting the bearded part of the face or the hairy scalp. The tubercles are large, often the size of a pea, hard, and at first inflamed. After a time they yield pus or matter which, mixing with the hair, causes a crust that resembles the cut surface of a fig. The disease when it is seated on the chin is called *sycosis menti*, when on the scalp, *sycosis capillitii*. In some instances of sycosis menti the "Microsporon mentagrophytes," and in other instances the parasite "Demodex folliculorum," is present. The term mentagra was once applied to a similar disease of the face, which was first observed in the reign of Tiberius, and was found to be contagious by kissing and other modes of contact.

Elephantiasis.

Elephantiasis is a term applied to two very different diseases; one a local affection, confined to the leg, called *Elephantiasis Arabum*, *Elephant leg*, *Barbadoes leg*, or *Elephas;* the other called *Elephantiasis Græcorum* or *true leprosy*, a general affection appearing on various parts of the body, or even covering the whole cutaneous surface.

Elephantiasis Arabum is an enlargement of the leg from swelling of the cutaneous tissues and of the cellular tissue beneath, the result of recurrent inflammation and serous infiltration from the blood. The affection becomes chronic, and the limb really assumes, as in a case lately under my own observation, the appearance of an elephant's leg and foot. It is usually a fatal disease from the exhaustion it produces, unless the affected limb can be amputated. It is not contagious.

Elephantiasis Græcorum or *true leprosy* is a tuberculous disease of the skin, epidemic or endemic, and contagious. It commences with erythematous blotches on the skin, which soon become dark or bronzed and tubercular. The tubercles are red and raised, and the skin, generally, about them is raised and roughened. There is often hoarseness of the voice, fetid discharge from the nose, and ulceration of skin with the other symptoms. The disease was well described by Celsus, who lived in the reign of the Roman Emperor Augustus, in the beginning of the Christian era. It is the true leprosy of the ancient world, and, as Wilson points out, was the epidemic leprosy which for fifteen centuries had a home in this country. The affection is believed to arise from a specific poison, and to have a period of incubation. It is attended in its first stages with fever. It is still present in the East and West Indies, in South America, in China, and in the Islands of the Pacific.

Frambœsia. Yaws.

Frambœsia or yaws is a disease of the skin, usually classed as tuberculous, met with chiefly in Guinea, amongst persons, negroes especially, who have been badly fed. The eruption begins, generally, on the forehead in white spots, like an insect bite, and then extends. The spots form matter which becomes incrusted, and beneath the crust an ulcer appears from which a fungous tubercle,

varying in color from white to red, rises. The eruption is apt to recur during a period often extending to nearly a year. It is not necessarily a fatal disease, and it is doubtfully contagious.

Aleppo Evil.

Under the term Aleppo evil is defined a disease of the skin commencing as a tubercle and extending until it forms a crust which falls off or divides, reforms, and at last leaves an ulcerated surface, often of large size. One or more of these spots of eruption may be presented. The disease in most cases continues for many months, and leaves, usually, an indelible scar, or a series of scars, behind.

Molluscum.

Under this term different authors describe an eruption of small tumors from the skin, appearing on various parts of the body without inflammation, and varying in size from a pea to that of a nut. The tumors may pass away without irritation or by ulceration. They may contain a sebaceous matter, or a semitransparent fluid, or an amorphous substance embedded in cellular structure and blood-vessels. The persons in whom they occur are sufferers from nervous exhaustion, are dyspeptic, and are of feeble circulation. In one remarkable instance under my own care an eruption of these small tumors, each of which resembled a large ripe white currant, broke out all over the body, lasted several days, and then rapidly disappeared.

Scleroderma and Leucoderma.

Under the term *scleroderma* is included a rare affection of the skin, which consists of a chronic inflammation of the deep layer of the dermis called the corium, and attended with hardness without increase of growth. The skin is drawn up or puckered in white lines or creases. When near to joints the hardness of the skin renders motion difficult.

Leucoderma, sometimes called *vitiligo*,—veal skin,—is an affection of white, smooth, shining tubercles, in patches, on the skin of the face, neck, and other parts of the body. The tubercles are often rapid in growth and then die away in a few days, leaving white surfaces or seams in patches or lines.

Acne, sycosis, elephantiasis, frambœsia, Aleppo evil, molluscum, and vitiligo, have been usually classed under the order "tubercula."

Stearrhœa.

An excessive oily secretion from the subaceous follicles, those of the face specially. There are two varieties:—1. *Stearrhœa simplex*, in which the secretion thrown out is almost colorless or faintly yellow; 2. *Stearrhœa nigricans*, in which the eruption and secretion are of dark color.

Albinismus. Canities. Melasma.

Albinismus is a partial or general change in the color of the skin, from an absence of the cutaneous pigment. The skin is of a peculiar shade, like milk, and the hair on the skin is white. The disease affects the dark races, giving rise to the "piebald negro," in whom portions of the surface of the body may asume a complete whiteness, in large patches.

The term *canities* defines change of the natural color in the hair to gray or white.

Under the term *melasma* is included the dark eruption seen on the limbs of old people. The change is due to an excess of pigmentary substance.

Chilblain and Frost-bite.

Chilblain is an erythematous condition produced by cold on the hands and feet of persons of weak circulation. The erythema and congestion may be extended deeply over a large surface, and often attended with swelling and much pain.

Frost-bite is a temporary death of the skin from the action of cold. The affected part, emptied of blood, is hard and insensible. During recovery the relaxed vessels are apt to become surcharged with blood, on which there is arrest of circulation and mortification or death of the part. The danger of mortification is often increased by too rapid an admission of warmth.

PARASITIC DISEASES OF THE SKIN.

The list of the Royal College supplies the names of ten diseases or affections of the skin as due to parasites or to irritation from parasitic living forms. In respect to certain of these as specific causes of the affections with which they are undoubtedly connected there is difference of opinion. Some would trace the diseases exclusively to the parasites, others would trace the parasites to the diseases, that is to say, they would maintain that the parasite does not cause the disease by its presence, but exists at the affected spots from finding there a favoring locality for its existence.

Tinea tonsurans. Ringworm.

An affection in which the scalp is the seat, marked in the first instance by shrivelling of the hair in patches of roundish or oval shape, and by falling off of the hair. The bare place is often scaly, and the roots of the hair are surrounded with dry matter. The disease often breaks out in schools, and is supposed to be very contagious. The parasite found in the affected part, in ringworm, is the "Trichophyton tonsurans," a vegetable spore round or oval in shape, transparent and colorless. The spores multiply around the root of the hair. Ringworm lasts a very variable time, but is always recovered from, and often with unexpected rapidity.

Tinea Decalvans. Alopecia. Baldness.

A disease of the scalp in which the hair is lost over large surfaces, or even over the whole of the head. The surface is left, not scaly, but white and shining. In old persons baldness seems to be as natural a condition as grayness of hair, but in the young and middle-aged it is a distinct disease. The parasite said to be present in some cases of this affection is the "Microsporon Audouini," a vegetable spore.

Tinea Favosa. Favus. Porrigo.

Tinea favosa, sometimes called "foreign ringworm," is a severe form of disease resembling in some respects the ordinary ringworm of this country. The hair is diseased and sometimes quite

destroyed. The parasite in favus is so abundantly developed that the spores, massed together, may be visible to the naked eye. The parasite is the "Achorion Schönleinii."

Tinea Versicolor. Pityriasis Versicolor.

An affection of the cutaneous surface, sometimes included with pityriasis capitis or dandriff, which, resembling, in some respects, the scaly disease already described under the head pityriasis, is supposed to depend on the presence of a vegetable parasite called the "Microsporon furfur," a spore of spherical shape, adhering to the epidermis and causing yellow or brownish spots of varying size.

Tinea Polonica. Plique.

A disease of the skin affecting the hair of the body in the scalp and elsewhere, in which the affected part is the seat of great irritation and is painful to the touch. There is an exudation from the roots of the hairs which dries into a crust, matting the hairs together, and causing a bad odor. The first symptoms may be attended with fever, which, however, soon subsides, and in time the growth of hair causes the crusts to be thrown off, with recovery. The disease is specially seen in Poland, hence the name Tinea Polonica. The parasite present is the vegetable spore "Trichophyton sporuloides."

Mycetoma. Madura Foot. Fungus Foot.

Madura foot, a disease first observed by Dr. Colebrook at Madura, in Madras. It is an affection commencing in the skin of the foot in those who go about with the feet uncovered. It is due to the action of a fungus parasite called "Chionyphe Carteri," Dr. H. V. Carter being the first authority who clearly reported on the nature of the affection and on the fungus which produces it. The parasite getting beneath the skin increases rapidly, and actually invades the bones themselves and causes their destruction. It is supposed by some observers that there is always some preexistent local disease or injury of the foot. Mycetoma not unfrequently ends fatally, from extension of the local affection, and the consequent pain and exhaustion.

Scabies. Itch.

The disease scabies or itch was classed by the old writers as a pustular disease, and was defined by them as an eruption of pustules with much irritation and itching, but with no fever. We now know it to be parasitic in its character. The face usually escapes from the eruption, but the wrists, the hands, and the flexures between the fingers are almost always affected, together with the flexures of the joints and other parts of the body. It is a disease essentially of dirt, and is communicable by contact of one affected body with another. It is due to the introduction beneath the epidermis of the female of the parasite "Acarus scabiei" or "Sarcoptes scabiei." Scabies sometimes assumes the character of an endemic or even epidemic disease. Dr. Arthur Hill Hassall has indicated that what is called "Grocer's itch" is sometimes due to a similar parasite which he has found present in inferior samples of sugar.

Irritation from External Parasites and Stings.

The skin is liable to irritation from other parasites which infest it on its surface, as from the "Pediculus capitis," the "Pulex" or "Chigoe," the "Cimex" or "Bug," and the "Leptothrix autumnalis" or "Harvest bug." The irritations from the stings of the wasp, the bee, the gnat, and other stinging insects, as well as from the stings of nettles and other stinging plants, are also considered as forms of cutaneous affection, of a temporary character.

General Affections of the Skin.

In addition to the special diseases of the cutaneous surface above noted, there are others of a general kind, the natures of which have been described in previous chapters under the heads of ulcer, tumor, fissure, carbuncle, gangrene or mortification, atrophy, hypertrophy, malignant disease, and furunculus or boil. The tumors affecting the skin are the *fatty*, the *fibro-cellular*, the *sebaceous*, the *cheloid*, the *condylomata*, *warts* or *verruca*, and *corns* or *cornua*. Of the malignant diseases, or cancers, affecting the skin, the *epithelial* is the most frequent form, but the *scirrhus* and the *melanotic* varieties are sometimes developed in it. Of the boils the most specific is the "Delhi boil" of India.

The skin is subject to injury and irritation, with swelling and thickening of structure, as in the case of an inflamed bursa, arising from pressure and friction. It is subject to sores and ulcerations from the same causes as in the *bed-sores* of those who lie for a long period of time in one position. It is subject to maculæ or marks:—(*a*) spots like *freckles,—ephelis:* (*b*) the vascular mark already described as *nævus* or mother's mark, of which there are two varieties; one where the nævus is raised above the skin, the other where it is a stain called, vulgarly, port-wine mark: and (*c*) *mole,* a raised growth above the skin, colored by dark pigment, and sometimes including in it hairs which protrude through the vascular mass, *nævus pilaris.*

The skin, lastly, is subject to contractions from the healing of wounds, *cicatrices:* to hardenings or indurations, as on the palms of the hands and soles of the feet: to *pruritis* or itching: to *anæsthesia* or insensibility in parts of its surface: to profuse *sweating* in parts, *ephidrosis:* to absence of *sweat,—anidrosis:* to wasting in lines, *linear atrophy.*

Diseases of the Nails.

The nails are subject to several kinds of disease, of which the following are the more important. 1. *Ingrown nail,* the growing in of the nail into the skin, a condition most common in the case of the great toe nail. 2. *Onychia,* inflammation of the matrix of the nail. 3. *Onychia maligna,* a rare and severe form of onychia. 4. *Whitlow,* an inflammation arising near the nail, ending in abscess involving the theca of the tendon, *thecal abscess.* 5. *Atrophy,* or wasting of the nail. 6. *Psoriasis* and *eczema,* affections causing much destruction and disfigurement of the nails, and usually occurring in persons subject to the same diseases on the skin. I have delineated, from nature, in my "Clinical Essays" a striking illustration of the disease psoriasis affecting the nails of a person who was also suffering from lepra, —psoriasis vulgaris. The affection commences with a tingling sensation beneath the nails, often described as "pins and needles." After a few weeks the nails look glazed, as if they had been smeared over with varnish of a yellow tinge. They then begin to show little indentations, as if they had been pricked over with the point of a pin, and afterwards rubbed with a dark substance. Finally, thickening occurs beneath the nail, with crumbling of

the nail structure and destruction. The disease is amenable to treatment. A new nail is generally reproduced in the process of recovery.

Diseases of the Cellular Tissue.

Inflammation.—The cellular tissue is often the seat of inflammation and of changes, connected with the inflammatory process, ending in the formation of purulent matter in a circumscribed form, *abscess.* Such inflammation is apt to follow under circumstances in which the skin is wounded, and in which the wound extends into the cellular structure. It also occurs from internal injuries, and from extension of inflammatory disease into the membranous cellular tissue. In deep-seated boils and abscesses, generally, there is extension of the inflammatory mischief into the cellular membrane.

Inflammatory induration, or hardening of the cellular structure in the newly born, is another disease of this structure, of which I have narrated several instances in my essay on "Diseases of the Fœtus in Utero." In these instances the surface of the body is rendered in parts hard and inflexible. Sometimes even the whole surface of the body is involved in the induration.

Slough or *Phlegmon* is another disease of the cellular tissue consequent on acute inflammation, and extending from the surfaces over or underlying the cellular layer. In erysipelas the inflammation may extend in this way, and rapidly involve large tracts of the cellular tissue, *phlegmonous erysipelas.*

Carbuncle or *Anthrax* is another special inflammatory affection in which the cellular tissue is involved. The inflammation is usually limited or circumscribed, and ends in the formation of pus or matter, which, after great swelling, tension, and redness, breaks through the skin in a number of small percolations, unless it be relieved by operation. The cellular tissue is involved, in like manner, in the disease called malignant pustule.

Obesity.—The laying up of fat in the cellular tissue beneath the skin and other membranes that are connected with the cellular structure becomes, when the fat is in great excess, an actual disease called obesity. Obesity is fertile of many mischiefs. It makes the body altogether pendulous, heavy, and cumbersome; it loads the intestines and interferes with their functional activity; and, when it surrounds the heart it very seriously impedes the

action of that organ. No mistake is more commonly made and no mistake is greater than that of accepting the external evidence of a free deposit of fat in the cellular tissue beneath the skin as a sign of robust health.

Emphysema.—When air or other gas finds its way, as it sometimes does, into the cellular tissue, and diffuses through it, the disease called emphysema is produced. Emphysema may occur from a wound in the cellular tissue, as when the end of a broken rib pierces it, and I have once seen the whole of the cellular tissue beneath the skin injected with air, as it is injected in the carcass of the dead animal when the butcher inserts a knife into it, and distends it by his breath. Emphysema may be present in any part where there is connective tissue. It is often present in the lungs.

Anasarca.—When water exudes in the cellular tissue beneath the skin, the form of dropsy called anasarca is produced. In anasarca the surface over the affected part becomes spongy, and "pits," on pressure, like dough.

Lastly, the cellular tissue is a common seat of *simple tumors.* It may, also, be the seat of *hemorrhagic effusions*, of *parasitic cysts*, and of *cancerous growths.*

BOOK I.

PART THE THIRD.

DISEASES FROM NATURAL ACCIDENTS.

CHAPTER I.

DISEASES FROM NATURAL ACCIDENTS.

THE history of natural disease would not be complete were reference not made to certain accidents to which the human kind is subjected. These may be divided into four classes. I. Accidents which are purely mechanical. II. Accidents which arise from poisonous substances developed within the body. III. Accidents from venomous organic substances. IV. Diseases from animal or vegetable substances, taken as foods. V. Accidents in the female, connected with pregnancy and labor.

DISEASES FROM MECHANICAL NATURAL ACCIDENTS. LIGHTNING SHOCK.

Primary effects.—The passage of lightning through the body may produce varied phenomena, from mere temporary shock, to shock with insensibility, and to shock that is fatal either at the moment or shortly afterwards. These phenomena may or may not be attended with marks of distortion or external injury. The fatality is in proportion to the intensity of the shock, and those discharges which by their intensity kill most readily, may leave least mark of distortion or external injury. In cases where the lightning shock has produced instantaneous insensibility, followed by recovery, the stricken persons have been, in some cases, altogether unconscious of receipt of injury. It may be inferred, therefore, that instant death by lightning is, as Franklin taught, the most painless of all deaths.

The injuries inflicted by the shock are internal and external. In my observations on animals killed by electrical lightning shock, I discovered that the course of the discharge through the body was, preferentially, by the blood, and that coagulation of the blood, general rigidity of the muscles, and decomposition of the tissues were the three proofs of death.

Secondary effects of lightning shock.—When the lightning stroke does not actually kill, a series of secondary effects, constituting what may be called actual diseases, may be induced, and may be named under the following heads. Reactive fever; apoplexy; convulsions and epilepsy; paralysis; catalepsy; and blindness.

Reactive Fever.—Sir Erasmus Wilson once directed my attention to a remarkable illustration of this effect of lightning in a woman sixty-one years of age, who was saved from instantaneous death by the wires of her crinoline which acted as conductors. After the shock, the woman, who had been suffering previously from indigestion, vertigo, and numbness of her limbs, remained insensible for twenty minutes, uttering an occasional groan. When consciousness returned, she stated that she had felt nothing at the time of the accident, although she had several burns on her body, but she complained of nausea and oppression about the chest, which were relieved by vomiting. Her skin at this time was cold and clammy from perspiration, and her pulse extremely weak. Subsequently she was attacked with fever, accompanied with delirium, and it was not until the end of ten weeks that she was reported to have recovered her usual strength, the burns being at the same time healed. At this period it was stated that she was quite cheerful, except when left alone, when she was disposed to sleep too much, and a feeling of great lassitude announced to her the approach of a thunder-storm, before its coming was perceived by others. "The case," adds Sir Erasmus, "is one of deep interest in its illustration of the influence of nervous shock, and its phenomena are most suggestive;—for example, a concussion of the nervous system, the loss of consciousness, the sickness of the stomach, the oppression of the lungs, the prostration of the heart, the reactionary fever, and last, but not least, the morbid sensitiveness of the nervous system to electrical impressions, enduring for a time, and probably for life. Is not this the oft-told tale of many of our fevers?"

Apoplexy.—Phenomena of apoplexy from lightning shock have been observed. In these instances the countenance is livid, the body affected with a cold clammy sweat, the breathing oppressed and stertorous, the pulse strong and full, and the powers of sense and voluntary motion suspended. The shock producing this condition is one of low tension, and is much like the shock

from sunstroke. Recovery has been known to take place on letting of blood.

Convulsions and Epilepsy.—Convulsive actions and epileptic or epileptiform seizures have been recorded as following upon lightning stroke. The paroxysm comes on some time after the shock, and it may return after apparent recovery.

Paralysis.—Paralysis has been observed to follow lightning stroke, the paralytic condition being either local or general. In all cases of lightning shock there is some degree of paralysis of sensation and of motion. It has been observed that during recovery sensation returns first.

Catalepsy.—The most remarkable phenomena of lightning shock are those of catalepsy. I have related an instance in which a man was struck by lightning in Grinsthorpe Park. He was rendered unconscious, but recovered and managed to reach home and go to bed. He was confined to his bed for several weeks, refused food, and sank into a cataleptic state which simulated death so closely that he was thought to be dead, was laid out by two women, and was tolled for in due order. He knew all that was going on, but was unable to move until he heard the women talking of his death and caught the sound of the passing bell. Under the dread impression that he should certainly be buried alive, he succeeded by a great effort in moving one of his thumbs, which fortunately attracted attention. He was then treated as one alive and recovered. During his convalescence he was annoyed by a strong smell of sulphur which seemed to come from his whole body; a phenomenon which was also observed by Gaultier Claubry, who experienced it for several days while recovering from lightning shock.

Blindness.—Blindness has been observed to follow lightning shock, and may be present from two conditions. (1) From a direct change in the structure of the cornea. (2) From nervous shock, without any visible mark of injury. To these may be added temporary blindness from the excitation of the light of the lightning flash without shock.

External injuries and marks left after lightning stroke.

Burns.—Burns are sometimes left on the body or on the hair after lightning stroke. The burnings differ in degree from mere singeings of the hair or skin to extensive cauterizations. Burns

are more likely to happen where the person is not destroyed by the shock. The reason of this is that the flash is of low tension, is of the character of a flame, and is not penetrating.

Metallic Impressions.—The impressions of metallic substances may be left on the bodies of persons struck by lightning. In a case I have reported, a man subjected to lightning shock had left on his body impressions of ornaments which he wore, namely, a chain, a coin, and a cross. The stain produced was of a dark brown color, and the impression was well marked. The nature of the mark is very simple. It is an ecchymosis or bruise through the metallic substance of which it presents a rough outline.

Ecchymoses.—Simple ecchymoses and livid spots having no reference to metallic or other substances in contact with the skin are sometimes seen on the surface of the body after lightning stroke. These spots were deeply marked on Professor Reichman, of St. Petersburg, the first martyr to science who lost his life by receiving a shock in the laboratory while drawing electricity from the clouds, on the 6th of August, 1753. He was killed instantaneously. On his forehead was a red spot, from which issued some drops of blood without wound on the skin. On the heel of the left foot and on the left side of the body were several blue spots resembling leather that had been shrunken by being burnt.

Arborescent marks.—Marks of an arborescent kind have been noticed on the bodies of persons who have been struck by lightning, which marks have, naturally though wrongly, been supposed to be representations of the figures of trees. The truth when explained is very simple. The arborescence is not the figure of a tree, but is an anatomical outline of the trunk and branches of the superficial veins of the body of the person struck.

Loss of hair.—In some instances where the nervous centres have been affected by lightning shock, death of the hair has been produced. On June 1st, 1864, at Moussy in the Vosges, a mason, aged fifty-nine, was caught in the rain and took refuge under a tree, where he was struck by lightning. He became unconscious, and thought four hours elapsed before he recovered his senses. He then found that he had lost the use of his legs, and could not speak, and it was not until after nine days that the paralysis ceased. The electric fluid had come into contact with the back of his neck, had passed down his lower extremities and had escaped, hurling his shoes to a considerable distance. Soon after

the event, the hair on the head and body of this man fell off entirely, the eyebrows, eyelashes, and beard being completely removed. There were no other external evidences of lightning shock.

SUNSTROKE—COUP-DE-SOLEIL.

Sunstroke, or coup-de-soleil, has been referred to under local diseases of the nervous system, at page 173. There are two kinds of it; one apoplectic in its nature, affecting persons of plethoric habit, and especially those who indulge in stimulants; the other syncopal in its nature, and affecting the feeble. The first is true sunstroke, as I should define it strictly, from what I have seen. The affection is rare in this country, except, in summer, when the heat is intense. It then happens to persons who go out without being protected from the direct rays of the sun. I have seen instances of it in adults of both sexes, and twice in children. The person affected is seized with a sudden giddiness or vertigo, followed by unconsciousness and want of power in the limbs.

In the apoplectic variety of the disease the face is livid, the veins swollen, the temperature of the body raised, the heart laboring, and the breathing heavy and stertorous; signs which in fatal cases continue until death. When recovery occurs it is often very rapid.

The syncopal variety is, according to my experience, rather an extreme faintness or oppression from heat than the effects of a sudden wave of heat. It is attended with coldness, faintness, clammy perspiration, and often with convulsion or hysteria, the attack lasting for several hours, and being followed by some reactive fever and a long-continued dyspepsia. I have known it to be succeeded by partial paralysis of the right side of the body, but it is much less serious, both immediately and subsequently, than the apoplectic form of the malady.

EXPOSURE TO COLD.

Exposure to cold is an accident fatal to life in two ways. First, by extreme action, as when a person is exposed to glacial cold without due protection from it; and, secondly, when a person in an enfeebled condition is exposed to the influence of moderate cold.

Under the first of these states, which may be called acute exposure, the extremities of the body, such as the nose and tips of fingers and toes, may be temporarily destroyed by the action of the cold, the parts being rendered entirely bloodless and insensible to pain, frost-bitten. In such cases, if due care be not taken to restore the circulation gradually, the frozen part is completely destroyed and removed by mortification.

If the whole body succumb to the influence of cold the tendency is for it to experience a sense of benumbing sleep, under which it falls into deep torpor and gradually dies, apparently without pain or sense of dissolution.

Under the second of the states of accident from cold the enfeebled person exposed to it becomes subject to congestion of some internal organ, which congestion passes into inflammation, with fever, and the sequelæ of both. The lungs are the organs which suffer the most severely, and from this exposure congestive bronchitis or congestive pneumonia are the forms of disease commonly manifested. Aged people, who in winter weather retire to rest in bedrooms insufficiently warmed, afford striking examples in all cold seasons of the dangers incident to this insidious action of cold.

Starvation.

The natural accident of starvation is presented under three sets of circumstances. 1. From actual deprivation of food, absolute famine. 2. From deprivation of certain portions of food which are essential to life. 3. From inability to swallow food, owing to disease or obstruction in the canal leading from the mouth to the stomach.

Starvation may be an acute or a chronic manifestation. When it is acute, that is to say when food is altogether withheld, there is rapid emaciation of body, fever with failure of muscular power, nausea, fetor of the breath, and, subsequently, a condition in which the ability to digest food and even the desire for food passes away. It has been shown by Mr. Cornish, in his observations upon the Indian famines, that when the second stage is reached the most skilful feeding rarely succeeds in saving life. The limits to which deprivation of food may be carried, without destruction of life, have not been fixed. Much, it would seem, depends upon the circumstance whether water is or is not sup-

plied. If water be withheld, death, probably, is inevitable in from seven to ten days even under favorable circumstances, much sooner if the surrounding air be dry and cold. But the evidence is clear that with a free supply of water the body may be sustained for a period extending over five weeks. I have myself seen an instance of such maintenance of life without food.

In examples of starvation from insufficient or improper supply of food the phenomena may present two characteristic forms. The disease which has been described at page 48, as relapsing or famine fever, may be the result of the starvation; or, there may be merely a feverish state and feebleness, ending in general exhaustion, ulceration of the surfaces of the body, paralysis of parts of the body, and general deterioration from which, at the best, recovery is but imperfect. Starvation from improperly selected foods is often well marked in young children who are fed on a diet which is too exclusively starchy, and does not contain the elements for building up the muscular and osseous systems. Such children become of lax and feeble muscular fibre and rickety in the skeleton, the muscles failing to receive their proper aliment and the earthy matter necessary for the solidification of bone being insufficiently supplied.

CHAPTER II.

DISEASES FROM NATURAL POISONINGS AND FROM ACCUMULATIONS OF POISONOUS EXCRETIONS WITHIN THE BODY.

In the course of some diseases symptoms occur which are of singular importance, and which seem to be due to the presence of poisonous substances which have been developed in the living body itself. These poisons may be considered as natural products or excretes of the body. Sometimes these excretes are nothing more than the natural products of excretion, excretes which are regularly made, and do no harm whatever so long as they are duly thrown off, or, as it is said, technically, eliminated. In health they are so eliminated, but under disease of the excreting organ the function of throwing them off is impaired, from which circumstance they may continue to be formed within but do not continue to be cast out of the body. They then accumulate in the blood and in the secretions, and, after a time, from such accumulation, exert all the effects of an active poison.

The above is one form of natural poisoning, but to it must be added another. It would seem that during certain forms of disease new poisons, which are extremely virulent in their action, are produced by modified chemical changes. It is probable that poisoning so induced is much more common than is generally supposed.

I shall have occasion to touch on this subject again when I come to treat of the causes of disease. In the mean time it was necessary to point out the two divisions of natural poisonings which have now been specified, and having briefly performed that task I may proceed to present short notices of the phenomena of disease incident to both forms of poisonous action from natural sources.

Diseases from Retained Excretions. Uræmia and Uræmic Coma.

We have seen in the chapter on the "Local Diseases of the Glandular System," p. 212, that the kidneys by their secretion eliminate, with every thousand grains of the secretion, fourteen grains of a substance which is called urea. Urea is a very soluble saline substance, a cyanide of ammonium. It is a white crystalline salt, easily separable from the secretion, and admitting of being made, artificially, out of the body. Like nitre and other saline substances which easily absorb water, it is, I found, an excellent antiseptic; but that which is most important to us is the fact that urea, if present in the body in excess, acts after the manner of a narcotic poison. In my original researches on this subject I found that whenever an animal body was charged with one part per cent. of urea, symptoms of sleep or coma were the result, and that in proportions above this amount the symptoms were, as a rule, invariably fatal. Similar observations have been made by other inquirers, and much discussion has taken place on the question whether the effects are due directly to the urea, or indirectly to another ammoniacal salt, the carbonate, into which it is easily decomposed. It is unnecessary here to discuss this point. It is sufficient to state that urea accumulating in the body leads to symptoms of a poisonous character which are always alarming, often fatal, and called uræmia or uræmic coma.

The conditions of disease which give rise to uræmia are connected with organic changes taking place in the structure of the kidney. In scarlet fever the minute uriniferous tubes cast off their epithelial lining profusely and become blocked up by it, whereupon the secreting power of the organ is impaired and, urea ceasing to be freely eliminated, accumulates in the blood and gives rise to the symptoms of uræmic coma, marked by prostration of the body, dilatation of the pupil, vomiting, darkness of the skin, convulsions, deep sleep, and insensibility—coma. In scarlet fever uræmic coma is a common cause of fatality.

In acute congestion of the kidneys, produced by exposure to wet and cold, described at pp. 212–13, the function of those organs may again be suppressed, with the result of causing uræmic coma, and with the same risks as happen when scarlet fever is the exciting cause.

In those forms of disease of the kidney described as "Bright's Disease," page 214, uræmic symptoms are apt to be developed, and in the chronic form of these maladies, in aged persons, uræmic coma is always to be dreaded. The symptoms often come on with an irresistible desire to sleep at almost any time or place. With this there may be deficiency of sensation in the limbs, occasional confusion of mind, feebleness, listlessness, and ammoniacal fetor of the breath. Persons so affected are readily influenced by cold or anything that checks the free action of the skin, and they often die with symptoms which, in former times, were called apoplectic. They are seized with drowsiness, vomiting, convulsion, and insensibility, under which they succumb. Such persons, when in a comparatively healthy state, are easily influenced by some medicines, such as opium, and, above all, mercury. They fall readily into uræmic disease under slight exposure to these deleterious influences. It will be seen from these data how large a part the excreted substance urea may play in the *rôle* of disease.

Asphyxia. Cyanosuria.

Other illustrations of phenomena of disease from deficient elimination of a natural excretion are shown in instances where the product of respiration, called commonly carbonic acid, is not duly eliminated by the lungs.

Certain of these phenomena are most strikingly seen during conditions which lead to what is known as asphyxia. If, under any circumstances, the respiration be interferred with, so that a due quantity of air is not taken into the lung, or a due escape of air does not take place from the lung, as occurs through suffocation from hanging, drowning, immersion in a mephitic atmosphere, and the like, there is accumulation of the carbonic acid in the blood and symptoms of danger and death from that cause. These symptoms are darkness of the face and surface of the body generally, coldness, convulsion, and insensibility. They are the acute symptoms of suppressed respiratory excretion.

In some instances the suppression of the respiratory excretion may be slower in character, and may give rise to symptoms very painful to bear and to witness, but not necessarily fatal, immediately. These states are usually brought about from some defect in the mechanisms of the circulation and of the respiration. In

the newly born it occasionally happens that there is an imperfect expansion of the air vesicles of the lungs, so that a portion of the lung structure is not brought into play. Thereupon there is diminished inspiration, which, if it do not prevent, from the first, the manifestation of life, leads to difficulty of respiration, coldness of surface, and impaired nutrition, with the common risk of early death from respiratory failure. To this form of disease the term *atelectasis* has been applied.

In other instances the opening from the right to the left side of the heart, the foramen ovale, which naturally closes after birth, remains open, and the blood from the right auricle of the heart, which ought to go altogether into the right ventricle, escapes, in part, as venous blood into the left auricle, and in this state, uncharged with oxygen, circulates through the body. Under these circumstances the body is rendered dark in color over all its surface, cold and enfeebled, a diseased condition which has already been under our observation at page 136, where it is defined under the head *cyanosis*.

In persons who are subject to spasm of the minute bronchial tubes, persons who are often called asthmatic, the same dangers from imperfect elimination of the expiratory excretion often occur, and death from asphyxia would be easily induced but for the circumstance that the prostration produced by the seizure leads to relaxation of the constricted tubes, and so permits the air once more to enter the temporarily occluded lung.

I do not doubt that there are many other conditions in which a deficient excretion of the respiratory products leads to disease, and even to death, by natural process of poisoning, and I know that much remains here to be explored and explained. Under the title " Asphyxia commencing in the Blood," I have described in another place various conditions in which this kind of poisoning may occur. It is enough for me in the present place to state the few well-defined illustrations which have been supplied under this head of Asphyxia and Cyanosuria.

Bilious Toxæmia.

When the secretion of bile is suppressed from organic disease affecting the liver or gall-bladder, so that there is not a proper secretion of bile, or when a proper secretion finds an imperfect

escape into the alimentary canal, the constituents of the bile are carried into the circulation and excite symptoms of bilious poisoning, jaundice, convulsion, coma. We have already studied some of these symptoms in treating of diseases of the liver, under the head "Jaundice," pages 211–12, and to these we need not again refer.

There are, however, certain minor symptoms due to the suppression of bilious secretion which deserve to be noticed under this head. These are commonly called symptoms of biliousness, or sufferings from bile, and consist of headache, nausea, depression of spirits, constipation, lassitude, and inability to apply the mind or the body to their respective labors. I believe it not unfrequently happens that more serious symptoms than these result from suppressed liver secretion, but I have named those which are most common.

Diseases from New Poisons developed in the Body.

I said in the opening sentences of this chapter that in various conditions of disease new products may be formed in the body, products which are not the natural excretions, but which are produced from unnatural decompositions progressing within the organism during some forms of disease. In my Reports to the British Association for the Advancement of Science I have pointed out that the substance amylene, an organic product which can be easily constructed in vital chemical changes, produces phenomena identical with those of somnambulism and with some of the phenomena of hysteria.

I have pointed out, in the same Reports, that another organic product, called mercaptan, sulphur alcohol, causes, when inhaled, symptoms of profoundest melancholy, and that, in the process of being eliminated by the breath, it gives to the breath an odor which is identical with the odor evolved in the breaths of many patients who are suffering from the disease called melancholia. From these observations I have ventured to suggest that various forms of mental affection and of nervous affection, depend, for their development, on the presence, in the body, of organic chemical compounds, formed and distilled through an unnatural chemical process carried on in the body itself.

I have endeavored to develop this subject somewhat further

by my researches on the action of lactic acid on animal bodies. I have shown by experiment that this acid, diffused through the body by the blood, acts as a direct irritant upon the lining membrane of the heart, the endo-cardium, and all the fibro-serous membranes of the body, so that a synthesis of heart disease and rheumatism can be established by its means. Lactic acid is the most copious product thrown out in the disease called rheumatic fever, and as many of the phenomena resulting from that disease take the same form and character as those producible by lactic acid, I infer, from the best evidence attainable, that this acid, the product of a fermentative change going on in the body during acute rheumatism, is the cause of the secondary structural affections which so frequently follow acute rheumatism.

It has been for some time past observed, by several able physicians, that persons who are suffering from the affection known as diabetes give off a peculiar odor from their breath, an odor which to some is like that of vinegar, to others of sour beer, to others a mixture of ether and chloroform, to others of acetic ether. I should compare it myself to the odor of grains as it is detected in a brewery. When this odor is observed in the breath of diabetic patients it frequently happens that they become sleepy, cold, and unconscious, with the result of coma and death. At one time it was supposed that these phenomena were uræmic, and were due to the presence of urea in the blood; but the absence of convulsion and of some other symptoms destroy this hypothesis, or at all events shake it. It is now believed that the symptoms owe their origin to the decomposition of the diabetic sugar which is in the body, and to the production from that decomposition of a volatile ethereal fluid called acetone, a fluid which has been discovered in the blood and secretions of these affected persons, who are said therefore to be suffering from the disease "acetonæmia." From the action of acetone upon animal bodies I infer that the theory of acetonæmia is founded on good evidence.

Lastly, under this head of poisoning from natural products of disease, I have to name the phenomena produced by the secondary absorption of poisonous material from abraded and ulcerating surfaces during the presence of acute febrile and contagious affections. The secondary absorption of diseased secretion from the throat in diphtheria and malignant scarlet fever, and the second-

ary absorption of poisonous matter from wounds, are all illustrations in point. The matter absorbed, entering the body and circulating through the blood, sets up new conditions of disease, which lead to various changes occurring within the blood itself, to separations of fibrine, to breaking up of the red corpuscles, and to various other changes of the most serious character. Sometimes in these decompositions ammonia is produced. Dr. Blair observed that sufficient quantities of ammonia are produced in yellow fever, to cause a degree of fluidity of the blood, which reduced that fluid to the thinness of water, so that it resembled a dark wine rather than blood, refused to enter into combination with oxygen, and became altogether incapable of sustaining life. Such observations as have been noticed under this short head lead to a study of another new point, namely, the possibility of the formation of organic alkaloids in the body during some conditions of disease. Scientific discovery has not, however, advanced so far as to enable me, at this moment, to do more than allude to one of the newest and most important studies in modern medical research.

CHAPTER III.

DISEASES FROM VENOMOUS ORGANIC SUBSTANCES.

THE College authorities classify, in their list, diseases arising from the body being subjected to certain animal and vegetable poisons. Under this head they include: (*a*) Poisoning by venomous animals, namely, snakes, scorpions, and stinging insects. (*b*) Poisonings by animals having infectious diseases, namely, glanders, farcy, equinia mitis, malignant pustule, hydrophobia, rabies and cow-pox, affections, all of which have been described in our chapter on diseases running a definite course, pages 44–58. (*c*) Poisonings by inoculation of dead or diseased animal matter. (*d*) Poisonings by animal or vegetable substances, used as foods.

DISEASES FROM VENOMOUS ANIMALS.

The venomous animals called snakes, which by their poison affect man, are best known as the viper, the cobra di capello, and the rattlesnake.

The peculiar secretion which is produced by these animals, and which is communicated in what is called their bite, is not poisonous unless it be injected into the body subcutaneously, or by a wound. This was proved by the famous experiment of the distinguished Dr. Mead, who himself swallowed some of the poison of the viper without suffering any bad effect.

When, however, the poison is introduced into the skin or mucous membrane by a bite, puncture, or injection, the phenomena of disease are rapidly set up. After the bite of the *viper* there is usually acute pain at the bitten part, often immediately and always within the hour. The pain rapidly extends and swelling and inflammation follow. Soon afterwards the general symptoms set in. The stomach is disturbed, the heart intermits or grows feeble; there is faintness, vomiting, dyspnœa, and complete

prostration. In extreme cases the collapse ends fatally within a few hours. There is as yet no known antidote for this disease.

The poison of the *cobra*, like that of the viper, is only effective when it is introduced by bite or incision. The action is, in the most deadly poisonings, not unlike that of the viper poison, but the depression is usually more immediately general and complete. In other and less virulent instances the symptoms are prolonged, time is given for the development of local changes, namely, death of the cellular tissue at the bitten part and surrounding inflammation. The blood also may be rendered extremely fluid; there may be vomiting, convulsion, and gradual stupor preceding the fatal collapse. The precise mode of action of the poison is still not understood. The poison seems to be easily destroyed in the digestive system and rendered harmless there, and I discovered that its powers as a poison are rendered abortive by exposure of it to sunlight. At the same time it may be retained in an active state for many years, if it be dried and carefully preserved in the dark. Its action seems to be immediately directed to the nervous system. According to my observation the poison that most closely resembles it in operation is nicotine.

The symptoms produced by the poison of the *rattlesnake* appear to be still more rapid in development, and in certain instances have been followed by a sudden collapse almost as decisive as that which follows a blow on the stomach. The mode of action of all these poisons is probably the same.

The mortality from the poisonous snakes is exceedingly large. In the Madras Presidency of India alone there are sometimes as many as two thousand deaths per annum by snake-bite. Various antidotes have been suggested and tried for the poisons of the cobra and rattlesnake as well as for that of the viper, but, unfortunately as yet, with negative results.

Disease from Stings of Insects.

The affections from the stings of insects such as the wasp and the bee, are usually only local in character, but are now and then very painful and troublesome if not dangerous. I have seen the sting of the wasp produce a local inflammation, followed by erysipelas, and prove dangerous though not fatal. The local symptoms induced are due to the fluid secretion conveyed by the sting,

and the effect has been supposed by some to depend on a zymosis or ferment. I am inclined myself to look upon it as resulting from the action of an organic acid.

Diseases from the Jelly-fish or Medusa.

The jelly-fish produces a peculiar secretion which, coming in contact with the skin, sets up an acute erythema, attended sometimes with an irritable vesicular eruption. The eruption is accompanied by a burning and tingling, and may last for several hours. In one instance, which came under my own cognizance, a bather in the sea, where a considerable number of jelly-fishes were floating, became so entangled in the meshes of a group of them that "he was stung over almost all the surface of his body." He suffered from an acute eruption which did not disappear for sixteen hours, and which was attended with two degrees of fever. In another instance, which also came under my own cognizance, a bather while swimming on his back, with open mouth, was stung in the throat, and was affected with so severe an inflammation as to cause considerable anxiety for several hours. The poison of the jelly-fish is, I believe, an organic acid poison.

Disease from Inoculation of Dead Animal Matter. Post-mortem Poisoning.

Under the head of disease from venomous substances we may include examples of diseased phenomena arising from inoculation of the living body with fluid or semifluid material derived from bodies that are dead. The most striking examples of this affection are witnessed in what are called post-mortem wounds. A physician or surgeon is performing a post-mortem operation, or a student or professor is making a dissection of the dead body. He accidentally wounds himself with a needle or knife which he has in use, and thereby inflicts a poisoned wound. If he can immediately suck out the poison or destroy the part by caustic he may escape. If he is not so fortunate he is subjected, in a few hours, to pain in the wounded spot, with redness round about it, inflammation running along the lymphatics, swelling of the lymphatic glands and fever, ending, not unfrequently, in prostration and death. In less formidable cases the acute symptoms are brought to a crisis by the formation of an abscess or abscesses in-

volving the lymphatic glands, as the glands of the armpit if the hand has been the part that has received the poison. In such examples the formation of the abscess may lead to subsidence of the more dangerous symptoms and slow recovery may be the result.

The disease thus induced is, I think, less frequent in these days than it was formerly, owing probably to greater care and cleanliness. I have seen four instances of it in my career, three of which terminated fatally. The nature of the poisonous matter or infection is little understood, but it seems to be a poison having a comparatively short duration in the dead subject. It does not seem to be formed immediately after death, and it appears to be destroyed very soon after the dead structure begins to undergo putrefaction. The late distinguished anatomist, Dr. Amadée Deville, who had seen many examples of the affection, told me that he had on no occasion witnessed the poisoning from a subject that had actually undergone decomposition.

Cases of poisoning somewhat similar to these are sometimes due to the eating of food which in a partially decomposed state comes into contact with an abraded surface or a wound in the mouth. I have elsewhere described an accident of this kind which affords a good typical example. A man partook of some jugged hare the flesh of which had become high previous to cooking. Beneath the tongue of the man there was an abraded ulcerated spot caused by friction from the stump of a broken tooth. A portion of the animal food lodged in this sore, and within twenty-four hours the symptoms of acute poisoning, local and general, had set in. The tongue became enormously swollen, there was intense fever and rapid prostration. The offending matter was sought for and removed, but without avail. The patient gradually succumbed.

I have on two or three occasions witnessed symptoms of disease in persons who have partaken of decomposing or, as it is vulgarly called, "high" food, although no wound was inflicted. The phenomena are those of indigestion, nausea, fetid breath and prostration: they continue until the poisonous material which has been swallowed is eliminated from the body.

Accidents somewhat similar to the above are occasionally met with by surgeons and veterinary surgeons when they are professionally engaged in dressing the wounds or sores of living animals. The accident may occur in very rare instances without the

infliction of a wound on the person who becomes infected, that is to say, by absorption through the skin. I have known one example of this kind where the poison from a specific wound came simply into contact with the reddened surface of an inflamed finger. More frequently a fresh wound is the centre of the infection, and the poison is thus directly inoculated. A surgeon of my acquaintance was once, unfortunately, inoculated fatally from a point of bone in the limb of a patient upon whom he was performing an operation.

The symptoms induced in these instances of poisoning vary according to the disease affecting the person from whom the poison is taken. If the poison is that of specific disease,—syphilis,—the person inoculated suffers from that disease should the poison take effect. In this manner it sometimes happens that the disease in question is communicated in vaccination by the use of impure lymph, that is to say, lymph taken from the arm of a subject who is at the time a sufferer from the specific affection.

In other instances the accidental inoculation of the morbific matter excites erythema in the part immediately around the wound that has been inflicted, which erythema may spread, and assuming the character of erysipelas may pass into an attack of erysipelatous inflammation.

In these forms of poisoning by inoculation the period of incubation varies according to the nature of the poison that has been introduced. The development of symptoms from the specific poison of syphilis is slow, the incubation being forty days. The action of the poison of erysipelas is rapid, the incubation being from a few hours to four days at the latest. The action of the poison derived from a post-mortem wound is still more rapid, commencing generally within a few hours after the infliction of the injury.

Disease from Wool. Wool-sorter's Disease.

In the process of sorting wools, especially that kind of wool called Van mohair, the workers are subjected to a peculiar and often fatal disease which arises from something which they inhale or absorb. The disease runs a fairly definite course, the period of incubation being about four days. The first symptoms are those of headache and pain in the chest with chilliness. These

signs are followed by restlessness, nausea, and, very frequently, vomiting. The countenance assumes a dark color, as in cyanosis. The breathing is difficult, the pulse fails, there is clammy perspiration of the body, reduction of animal warmth, insensibility, muttering delirium, and death. This is a description of an extreme but by no means unusual case, for the mortality in woolsorter's disease is very great. It is supposed by some that the disease is due to a bacterium called *baccillus anthracis*. The evidence is as yet inconclusive.

CHAPTER IV.

DISEASES FROM ANIMAL AND VEGETABLE POISONS TAKEN AS FOOD.

Disease from Poisonous Fish.

Siguatera.

In tropical climates the perch, the gurnard, the goby, the sardine, and the two varieties of globe fishes, the diadon or two-toothed and the tetradon or four-toothed, are all, at particular seasons, causes of disease when they are taken as food. The poisonous substance is developed in their digestive organs, in the spawn, and in the liver of the fishes; it is most potent in those fishes which have arrived at maturity of growth.

The Spanish colonists give the name of Siguatera to the symptoms of acute disease which result from the eating of poisonous fishes in hot climates. The phenomena of disease that are presented are of two kinds—gastro-enteric and nervous. The gastro-enteric form of disease begins with a severe attack of indigestion, followed by great pain in the stomach, and by all the indications of gastro-enteric irritation, viz.: nausea, vomiting, first of food then of mucous fluid, diarrhœa, coldness of the body, depression of the pulse, and cramps. The nervous type of the disease is marked by sudden muscular prostration: the face of the sufferer becomes flushed and then pale; the pupils are contracted; the lips are swollen and blue; the pulse is weak, quick, and intermittent; and, very soon, there is general convulsion with inability to exert any volitional power. Death quickly occurs unless skilled help be at hand.

Both these forms of the siguatera are dangerous to life. Recovery from the gastro-enteric form is rapid when it commences, but the nervous type of the malady causes, for several days, extreme debility and irregular action of the heart. The poison,

whatever may be its nature and composition, excites, it is clear, a most effective irritation of the pneumo-gastric nerves, an irritation as truly energetic as that which might be excited by submitting the nerves to the influence of a series of electrical discharges.

Mussel Poisoning.

Some very serious forms of disease have been produced by taking mussels as food. There are certain persons who seem specially liable to irritation of the stomach even from taking a small quantity of mussels. There are others who suffer from nettlerash from the same cause. These facts are so general that the inference has been drawn that at certain seasons the mussel produces an irritant poison. In exceptional cases poisoning from mussels has been extremely severe and even fatal, the symptoms resembling those which have been described above as constituting the disease siguatera, with other peculiar nervous symptoms. The indications are those of nausea and vomiting, followed by constriction of the mouth and throat, difficulty of speech, numbness of the limbs, muscular exhaustion, coldness of the body, and death with faintness and torpor. Notwithstanding the violence of the symptoms, the appearances after death have been rarely of sufficient importance to explain any fatal phenomena. The real nature of the poison remains up to this day unknown. At one time it was supposed to be a salt of copper with which the mussels themselves were charged, but analysis, in fatal cases, has failed to establish this view. The probabilities are that the poison is of an organic kind, and is produced by the mussel itself at particular seasons.

The oyster has been accredited with producing disease under some circumstances, and I have myself known one example of oyster poisoning; but the occurrence is extremely rare. The symptoms are those of nausea and irritation of the stomach.

In the books of a recent past day treating on disease from foods, references are made to poisonous effects produced by the taking of sausages, pork, milk, and other animal substances. The symptoms cited refer, in nearly every case, to irritation affecting the alimentary canal, and various speculations are offered to account for the phenomena that have been observed. In these days much light has been thrown on that part of the subject which relates to disease from sausages, pork, and bacon, owing to the dis-

covery in such foods of trichinæ and other parasitic forms of life. It is probable that in nearly all the instances of the kind recorded by the older writers the irritations described were due to parasitic introductions. We know now also that milk may be the bearer of various organic poisons, such as the poisons of typhoid fever, cholera, and probably diphtheria.

Poisoning by Vegetable Substances.

Instances still occur in which peculiar forms of disease are produced by accidental feeding on vegetable substances which are poisonous. Fortunately these accidents are much less frequent than they were in former times; but, the College authorities still refer to the disease known as ergotism produced from taking ergot of rye; to disease from poisonous fungi and mouldy bread; and, to disease from certain poisonous grains or seeds, especially of the everlasting pea,—*lathyrus sativus.* I need to dwell only on two of these, namely, on ergotism and disease from the poisonous fungi.

Disease from Ergot. Ergotism.

Ergotism is an affection of a very distinct character, produced by eating the spur which forms on rye and other grasses, ergot, *secale cornutum.* This spur is a growth affecting several kinds of grain, especially rye, and the disease which it produces has, consequently, been most commonly observed in countries where the poor have fed on rye bread.

Ergotism, the disease caused by the ergot, takes two forms; one called *convulsive*, the other *gangrenous* ergotism.

Convulsive ergotism is marked by vertigo, yellowness of the skin, thirst, pains in the limbs and chest, cramps and convulsions, insensibility and death, with, in some examples, an eruption of dark spots on the body. In districts where the rye has been largely used the disease has assumed the epidemic form.

From the analogy which exists between the symptoms above described and those which characterize the severe affection recently recognized as cerebro-spinal meningitis or tetanoid fever, I have suggested that this latter disease is probably due to taking a diseased grain analogous in character to ergot. This view has received confirmation from the observations of the late Dr. Day of Stafford and of Dr. Baker of Michigan.

Gangrenous ergotism is a disease of much slower development and longer duration that the convulsive variety. It commences with debility and sense of tingling over the surface of the skin. The limbs then become cold, pale, and so benumbed that they are insensible to pain from external impressions. After a time pain comes on independently in them and is followed by death of the extreme parts, so that the fingers and toes completely die off by a dry gangrene. These last symptoms have given rise to the name gangrenous ergotism.

Poisoning from Fungi.

It still occasionally happens that accidental poisoning occurs from taking poisonous fungi,—those especially which are mistaken for the common mushroom, *agaricus campestris.* Christison defines that most fungi which have a warty cap with fragments of membrane adhering to their upper surface are poisonous; that all which grow in tufts or clusters from the trunks or stumps of trees are dangerous; and, that the sure tests of a poisonous fungus are an astringent styptic taste and a disagreeable pungent odor. The poisonous principle seems to reside in the juice of the fungus, and has narcotic and irritant properties.

The symptoms produced by the poisonous fungi vary, but, taken as a whole, are definable as narcotic and irritating, the irritation being seated in the alimentary canal and leading to great disturbance of the stomach and bowels. Sometimes the narcotic symptoms are dominant, in others the irritative. In an example under my own observation, where the fungus called toadstool was eaten by four children in mistake for mushroom, three suffered entirely from intestinal irritation, and one from the narcotic effect, which lasted until the offending substance was removed by purgation artificially induced. During the time when the fungus is producing its effects the body is cold and faint, while in the reaction which follows there is fever which lasts for several hours. The acute symptoms of poisoning occur, as a rule, within one or two hours after the fungus has been taken, but exceptions have been known in which several hours have elapsed before the development of the phenomena.

CHAPTER V.

DISEASES AND ACCIDENTS CONNECTED WITH PREGNANCY AND CHILDBIRTH.

During the pregnant state the female of human kind is liable to suffer from various local affections which are considered special to her condition at that time. Some of these affections are most distressing, but happily it is rare that the worst of them become fatal. In this brief chapter I will condense what needs to be said under different heads, according to the parts or systems of the body that are particularly affected.

Disorders of the Digestive System.

One of the earliest derangements of pregnancy is a *depraved and capricious appetite.* The ordinary sense of taste is often much perverted; there is particular distaste for certain articles of food, and particular desire for others, such as shell-fish, cream, and various other delicacies not specially cared for under ordinary circumstances. This perverted taste and desire will often last for two or three months. Occasionally, with or without perversion of taste, there is a free and excessive secretion of saliva—*salivation.*

Nausea and Vomiting, are other common dyspeptic affections in the earlier periods of pregnancy, and in certain instances they continue until the late months, giving rise to extreme misery and exhaustion, and remaining unchecked by any and every attempt at relief. The nausea or vomiting commonly comes on periodically, and most frequently in the early morning, lasting for many hours each day.

Heartburn, or cardialgia, is also a dyspeptic phenomenon in pregnancy, and when it is frequent it becomes very oppressive. It is commonly accompanied by eructation of acid fluid from the stomach into the mouth,—*pyrosis* or *water-brash.*

Intestinal cramp, or colic, is another affection of the pregnant state, which causes severe suffering if it take place in the later stages when the uterus has attained a large size.

Derangement in the action of the bowels is by no means infrequent during pregnancy. In some persons the derangement is from *constipation*, in others it is from *relaxation*, or *diarrhœa*. Together with these derangements of the bowels there may be disorder of the liver, with *jaundice* as a temporary accompaniment.

Disorders of the Circulatory System.

The circulatory system is apt to become painfully affected during the pregnant state. An obstruction to the flow of blood back to the heart by the large veins, an obstruction caused by the pressure of the enlarged uterus or womb, may give origin to enlargement of the veins in the lower parts of the body. Thus may arise large or *varicose veins* of the lower limbs, and *hemorrhoids*, or *piles*.

From the same pressure and obstruction to the return of venous blood there may be effusion of serum into the peritoneal cavity,—*ascites*; a serous effusion into the cellular tissues of the lower limbs,—*œdema*. From irritation connected with the uterus in various stages of pregnancy, and from reflex nervous action, the heart is sometimes disturbed in its movements and rendered *irregular*; or, the rapid action of the heart, known as *palpitation*, may be induced; or, the motion of the heart may be brought temporarily to partial arrest, and *syncope* or faintness be the result.

Disorders of the Respiratory or Breathing System.

Three disorders of the respiratory or breathing system are noted in the College lists as specially connected with the pregnant state. The first is *Dyspnœa*, or difficult breathing, an affection most commonly developed in the later stages, when the enlarged womb pressing upwards upon the diaphragm interferes with the movements of that great muscle of respiration, and encroaches on the cavity of the chest itself. This oppression of breathing, though not in itself dangerous, except in the rarest instances, is distressing, and frequently remains until the end of the condition

from which it springs. The second difficulty named is called *orthopnœa*, and is, in fact, a dyspnœa, or difficult breathing, during which respiration can only be carried on, effectively, when the body is sitting up or standing. On lying down the chest cannot be duly filled with air. This derangement is not, as a rule, dependent on pregnancy alone. It is usual for the person in whom it occurs to be at the same time affected with some actual derangement of the breathing organs themselves, such as asthma or chronic bronchial disease. The third disorder named is described simply as *cough*, and refers to a frequent or it may be a constantly recurring cough, excited by reflex nervous action from uterine irritation. The cough is most commonly developed during the early part of pregnancy, and often goes away, entirely, in the later months.

Disorders of the Nervous System.

The nervous system is most apt to be subject to disorder during the period of pregnancy. The following are the derangements officially defined as the most important.

Neuralgias.

Neuralgiac pains, of a very acute kind, are of rather common occurrence. They often start suddenly, without any previous warning, excite excruciating pain, and then pass away in a moment, with as little apparent reason for ceasing as for coming on.

There are three varieties of these neuralgias of pregnancy, each one named after the part affected. 1. *Odontalgia*, a sudden and severe neuralgia in a tooth, presenting itself as a toothache of the intensest character. The tooth or teeth in pain may be quite free from organic disease. 2. *Cephalalgia*, a similar intense pain affecting the head, and producing what is described as violent and intolerable headache. 3. *Mastodynia*, an extreme neuralgic pain affecting the breast; perhaps the most intense of all, but happily the least frequent. To these forms of neuralgia might also properly be added facial neuralgia,—*tic doloureux;* stomach neuralgia,—*gastrodynia;* and neuralgia of the sciatic nerve,—*sciatica.* I have known these last-named derangements happen as frequently during the pregnant condition as the three specially no-

ticed, although they are not so severe, and are, therefore, not distinctively classified.

Chorea and Convulsions.

The affection which we have already had before us under the name of chorea, or St. Vitus' dance, is sometimes present during pregnancy, as if dependent on the peculiar condition of the patient. When it is called forth the sufferer is, I think, always predisposed to it, or to some allied nervous disease. The chorea, in the majority of instances in which it is present, is marked in the earlier stages and subsides in the later, but I have known it to continue quite to the end, and only cease after childbirth. In this form of chorea there is no necessity for the existence of any organic disease as its cause. It may be entirely dependent on uterine irritation in a predisposed subject.

Convulsive seizures may take place during pregnancy, and may be hysterical in character, or true. The hysterical convulsion is commonest in the earliest portion of the period, and though alarming to those who look on is, in reality, attended with little danger, and is not likely to be of permanent nature. The true convulsion is commonest in the later stages of pregnancy, is often due to the uterine pressure and temporary congestion of the spinal cord, and may be of serious import. Fortunately the convulsive derangement ceases, with few exceptional instances to the contrary, at childbirth.

HYPOCHONDRIASIS AND MANIA.

The pregnant woman may be subject to that singular depression of mind and morbid sense of fear and fancy, which we have had before us in a preceding chapter under the head *hypochondriasis*. The affection is exceedingly uncommon in women at any time, and is not very common in the pregnant woman. I have seen but one illustration of it in practice. When it does occur the sufferers are, constitutionally, of a nervous temperament, hysterical and desponding, and the symptom which lasts during almost all the period is not always removed by the act of childbirth. It should be looked upon rather as a constitutional than a special condition.

Mania is a less uncommon disorder of pregnancy. It assumes

the character of an acute madness when it is developed. It is developed in any portion of the period, though most often in the second or third month; it may be of short duration, but it is apt to be recurrent. It is, I think, only seen in those in whom the proclivity to mental derangement is strongly marked.

Disorders of the Glandular System.

It has been stated that salivation or overaction of the salivary glands is an occasional symptom during pregnancy. Other glands are sometimes affected, the kidneys being those most likely to be implicated. This may easily be assumed when the position of the kidneys in relation to the increasing pressure produced by the enlarged uterus is considered.

Albuminuria from the pressure of the womb on the kidneys, and the congestion incident to the pressure, is a functional derangement of moment when it is present. The symptoms are those which have been described under the head of acute Bright's disease at page 214. They are, fortunately in the large run of cases, only temporary in character, and they disappear when the act of childbirth has passed over.

Dysuria, or difficulty of voiding the renal secretion; *incontinence*, or difficulty of retaining it; and *retention*, are other temporary derangements incident to the pregnant condition, which, though very painful to bear, are rarely prejudicial to life.

Derangements of the Uterine System.

During pregnancy the organs most concerned, the uterus and its neighboring parts, are apt to be subject to derangement beyond the changes natural to their function in the process of child-bearing. The uterus during this state may be affected by inflammation, *metritis*, giving rise to uterine irritation, to fever, to sympathetic pain in the stomach, and to hysteria. It may be liable to discharge of watery fluid, *hydrorrhœa;* to *rheumatism;* to acute nervous pain unattended with inflammation, *hysteralgia;* to spurious pains like those of labor; to severe *spasm* or *cramp;* to discharge of fluid colored with blood, *sanguineous discharge;* to actual loss of blood, *hemorrhage;* and, to the three kinds of *displacement:* (*a*) prolapsus; (*b*) hernia; (*c*) retroversion, which have been explained in a preceding page.

Affections connected with Delivery or Parturition.

The delivery of the child may be contrary to natural course from three causes: 1. From delivery before the completion of the development of the child to the extent of enabling it to exist as an independent life; *abortion.* 2. From delivery after the time when an independent life could be sustained, but before there is complete development for natural birth; *premature birth.* 3. From development out of the uterus itself, as in the Fallopian tube; *extra-uterine gestation.*

When the period of development has attained its natural duration and the growth of the child is complete, so that it is ready to be born, there may be affections connected with its birth, from uterine or other causes, which are briefly classified as follows:

Atony, or want of power in the muscular walls of the uterus for due expulsive effort.

Over-distention of the uterus. (*a*) From excess of the liquor amnii or fluid surrounding the child. (*b*) From presence of twins or triplets.

Mechanical obstruction to the action of the uterus from a variety of causes. (*a*) From occlusion or closure partly or wholly of the mouth or neck of the womb or of the passage below. (*b*) From rigidity, narrowness, cicatrix, cystic growth, cancerous growth, prolapsus of the bladder, distention of the lower bowel, or, prolapsus of the bowel. (*c*) From tumor; uterine, ovarian, pelvic, or external. (*d*) From polypus. (*e*) From fracture of the pelvis or bony basin which supports the abdominal organs. (*f*) From exostosis or bony thickening of the pelvis. (*g*) From distorted, or contracted, or diminutive pelvis. (*h*) From dislocation of the lower or lumbar vertebræ into the pelvis. (*i*) From fixidity or anchylosis of the terminal bone of the spinal column, the coccyx. (*j*) From extreme anteversion of the womb with pendulous abdomen. (*k*) From peculiarities of the child, namely, excessive size, malposition, malformation, or enlargement from disease. (*l*) From unusual thickness and resistance of the membranes which envelop the child. (*m*) From unusual shortness of the umbilical cord, the vascular cord which connects the body of the child with the placenta or after-birth.

Hemorrhage.

Hemorrhage, or loss of blood during labor, is one of the serious accidents which sometimes occur, and which occasionally prove fatal during childbirth. In these days, however, so exact has obstetric practice become in the hands of scientific practitioners, that fatal loss of blood or hemorrhage during parturition is comparatively rare. In no department, in short, has medical science come nearer to exactitude of rule, and with more success from exactitude, than in this department of the treatment of the parturient woman.

Uterine hemorrhage during delivery is said to be of the three following kinds:

1. *Unavoidable hemorrhage*, or *placenta prævia*, from the placenta presenting itself for birth before the child. The placenta is the interconnecting organ between the mother and the child; and, as the mother supplies it with blood, as the child derives its supply of blood exclusively from it and returns its blood to it by the umbilical cord, and as it is a net-work of blood-vessels, it is almost impossible that it can be expelled first without the accident of loss of blood. Hence this hemorrhage is styled unavoidable. Fortunately here medical art, again, comes in, and by changing artificially the mode of delivery, brings down the child first and averts the danger. The operator skilfully converts the accidental into the natural condition, and secures the safe delivery.

2. *Accidental hemorrhage*, in which the placenta is accidentally detached, is a second form of loss of blood which may occur during childbirth. This danger, like the last named, is now usually averted by the skill of the obstetrician.

3. *Thrombus* of the neck of the womb, or of the parts, or labia, beneath is said to be another cause of hemorrhage. The term thrombus is a very absurd one, but it means really in this instance a swelling attended with much distention of the blood-vessels, or effusion of blood into the soft tissues, followed by actual loss or escape of blood during delivery. It is a rare accident, and is not generally fatal when it does take place.

Mechanical Injuries.

Mechanical injuries to the mother occurring during childbirth are somewhat common and may be very severe, leading to long-standing and troublesome affections. These injuries consist of ruptures or lacerations of parts involved in the act of parturition, and are classed under four divisions: (*a*) Rupture or laceration of the uterus or womb. (*b*) Laceration of the vagina or canal leading from the womb to the outlet. (*c*) Rupture of the urinary bladder. (*d*) Laceration of the perineum or stretch of skin and muscle between the outlet from the uterine passage to the outlet from the lower bowel.

The gravity of the injuries thus inflicted is very different in character. Rupture of the uterus or womb is an accident of exceedingly rare occurrence, and happily so, because it is almost of necessity a fatal accident. The same may be said of rupture of the urinary bladder. Rupture of the vaginal canal, also rare, is a serious but not necessarily a fatal accident. Rupture of the perineum is the most frequent accident, and at one time was followed in many cases by extreme after suffering, which lasted throughout life. The tear or laceration produced remaining unhealed, a source of support was lost, and the deficient sustainment caused a persistent infliction. Now, by operative skill, brought to a degree of perfection which leaves little to be desired, the ruptured parts are made to reunite and assume their original and natural function. Amongst women of savage tribes, who are unaided during childbirth, the accident of laceration of the perineum is common, and so serious as to be a cause of premature exhaustion and decline. The uterus may also be *inverted*, turned inside out, from childbirth, an accident which, though formidable to read of, is less dreaded by the accomplished accoucheur than many others that have been referred to and that seem of less importance.

Accidents with the Placenta or After-birth.

Delivery of the placenta or after-birth is sometimes a cause of difficulty and of danger during childbirth. In the natural way the placenta is thrown off entire, by one or more contractions of the uterus, a few minutes after the birth of the child, upon which

the uterus, fully contracted and feeling like a cricket ball through the walls of the abdomen, remains in a quiescent state, whereby the act of childbirth may be said to be completed. Under less natural circumstances the placenta may be a cause of trouble from what is technically called its *retention.* Retention of the placenta is induced by one of three causes : (1) It may fail to be thrown off owing to atony, or want of expulsive power of the uterus. (2) It may be retained by an irregular contraction, or, as it is often designated, "hour-glass contraction" of the womb, the organ being contracted in its centre, something like an hour-glass, and holding the placenta firmly in the contracted part or enclosing it in the space above. (3) It may be detained by preternatural adhesion to the uterine wall, and may be so adherent that considerable force has to be used in removing it from its attachment. All these difficulties are in our day met by the skill of the obstetrician, who removes the placenta without subjecting the childbed woman to danger from its long detention.

Affections Following Childbirth.

There are several affections following childbirth which deserve to be briefly stated. The most immediate of these is loss of blood, called technically *post-partum hemorrhage*, and which is often consequent on one or other of the causes which have been noticed in connection with childbed hemorrhage itself. There is a fever of a temporary kind, which sometimes follows the reaction of labor and is called *puerperal ephemera.* This has already been described as the affection termed milk fever or weed, at page 56, amongst diseases that run a definite course. Under the same head is also included the serious affection following childbirth called *puerperal* or *childbed fever*, a distinctly contagious malady. To these have to be added, as occasional affections, inflammation of the peritoneum, *metro-peritonitis* and *puerperal peritonitis ;* the formation of abscess in the iliac or pelvic regions, *iliac* or *pelvic abscess ; sloughing* of the neck of the womb or neighboring structures; the various kinds of *fistula*, which have been described already ; *inflammation* of the *breast*, and *breast abscess.*

Two other affections following on childbirth are of a kind in which the nervous system is involved, namely, puerperal convulsions and puerperal mania.

Puerperal Convulsions. Eclampsia.

Puerperal convulsions have a distinction and importance as indicating a special form of nervous disturbance. The convulsive seizures may commence during the period of labor, but more commonly they follow delivery. They may continue in repeated paroxysms for several hours, and be attended by insensibility, the end, unfortunately, being in many instances fatal. I believe, from my own observation of the phenomena and of the causes that lead to them, that there are at least two varieties of eclampsia: one, in which the convulsive moments are reflex, and result from irritation in the parts locally concerned in childbirth; the other, in which the seizures are due to the accumulation in the body of some poisonous excrete, probably urea, which ought to have been thrown off by natural excretion, but which has been retained, owing to the pressure of the gravid womb on the excreting renal glands. The nature, however, of eclampsia remains yet to be learned with precision, as does also the grave question of its successful management for the purpose of prevention or cure.

Puerperal Mania.

Puerperal mania may be connected with parturition or with the yielding of milk, lactation. The attack is of a mental kind, and is often at first very severe, amounting to violent frenzy, with aberration, under which deeds of violence of the worst kind may be perpetrated. The severity of the acute symptoms is sometimes resolved by sudden and complete return to mental health; but, more commonly, the acute stage is succeeded by one of melancholy and depression which lasts for many weeks or even months. In most instances of puerperal mania the hereditary proclivity to mental disease is distinctly marked. One of my medical confrères, who during a professional life of fifty years had been engaged actively in attendances at childbirth, once reported to me that he had never known an instance of the disease in which the proclivity was not traceable.

Still and Premature Birth.

The College authorities place under the head of "conditions not necessarily associated with general or local diseases," still and premature birth. These accidents, occurring naturally, are due

to a series of causes rather than to any one particular cause. They are sometimes due to accidents which befall the mother, such as frights, falls, and other physical shocks, enfeebled health, anxiety, insufficient rest, impoverishment, and the like. They are sometimes due to intra-uterine changes, such as degeneration of the placenta and accidents to the umbilical cord. Again, they may be due to diseases originating in the offspring itself, diseases which extend to more than fifty in number, including many of those which affect persons in full life, not excepting cancer itself, of which there is more than one recorded example.

Once more, the event of still-birth may happen from disease which the offspring shares with the mother, such as communicable disease like small-pox or fever, or disease from absorption of mineral poisons like lead, or vegetable poisons like ergot or opium. In such cases it sometimes happens that the child dies while the mother recovers. The still-birth event may also be the result of accident, or of difficulty occurring in the act of childbirth.

But on the whole the great cause of still and premature birth is constitutional in its nature, and is specially due to that taint of constitution which I have had to describe as specific disease, syphilis. This cause may affect the offspring through either of its parents or through both. It leads to impaired nervous life in the offspring and thereby to impaired nutrition, and it leads commonly to degenerative changes of the placenta or intercommunicating vascular link between the mother and the child. Thus directly and indirectly it is of fatal significance.

BOOK THE SECOND.

ACQUIRED DISEASES.

DISEASES OF ARTIFICIAL ORIGIN. PHENOMENA AND COURSE.

INDUCED OR ACQUIRED DISEASES.

In the previous book, treating on the history and phenomena of what, in the present state of our knowledge, may fairly be called natural diseases, I have classified the diseases according to the parts of the body in which they are manifested. This plan seemed to me to be logical, because in the natural diseases the phenomena presented are distinctive, while the causes are often obscure, and admit only of being discussed after the phenomena to which they give rise are correctly known. The causes are not such as we ourselves knowingly produce, or primarily understand; they are therefore only discoverable by tracing them back through their effects, and under the most careful tracing they still remain, to a large extent, unknown.

The diseases to be discussed in this second book, are diseases artificially produced, and, if I may so express it, are of human device. They are induced or acquired. The causes of them are in our own hands. We produce them, and the phenomena flow from such production. It would not be logical, therefore, to put forward the phenomena barely, and afterwards to treat of the causes. It is the natural course to classify the causes, all of which are known, in the simplest possible manner, and to display the results springing from them in direct line.

This procedure is the more necessary because, as will be seen by the history that is to follow, the diseased states which date from human origins, are less localized in character than are those which are of natural development. Thus out of one cause of artificial origin three or four, or even more, distinctive forms of disease may arise, so that a classification dependent upon the phenomena, apart from cause, would lead to endless complication and to repetition of the same cause for various diseases.

It may be that in course of time, as knowledge expands and generalization becomes sounder, the natural diseases will be viewed in this same light, and that numbers of natural diseases,

now distinguished by particular names, as if each one had a definite cause, will be traced to some common cause, which will be absolutely known. If this be true, as, after a most laborious study of the question, I believe it to be, the contrast of arrangements presented in the first and second of these books may be of special service to two classes of students. First, to those who may devote themselves to the successful study of unity in causation; and, secondly, to those who may desire to follow up the progress of learning, stage by stage, from the general and doubtful into the particular and positive.

With this explanation I enter on Book II., in which I attempt to describe the diseases affecting human-kind from agencies which are under our own control, and which we, either by accident, necessity, or fruitless intention, set up and promote. The agencies are of various kinds. Certain of them are carried into the body as inorganic or organic poisons, which find their way, accidentally, into the organism and affect large classes of the community, some of whom are brought into contact with them in the course of productive labor, others of whom come into contact with them by the use or employment of the results of productive labor. Certain of them are physical agencies which come into operation on the body, while it is employed in various mechanical occupations which may be after the manner of work for the carrying out of useful or necessary arts, or after the manner of pleasure, amusement, travelling, or the various forms of what is called exercise. Certain of them again are mental agencies which affect the body through the emotions or passions, through over-mental work, through various moral influences which tell upon the mental and physical health, and through numerous habits or modes of life, of a settled kind, which have either been enforced, cultivated, or otherwise made a second nature.

I shall arrange the acquired affections thus briefly named and epitomized under the following heads, relating, as will be seen throughout, to the causes which gave them birth.

I. Diseases induced or acquired from inorganic and organic poisons.

II. Diseases induced or acquired from physical agencies, mechanical and general.

III. Diseases induced or acquired from mental agencies, moral, emotional, and habitual.

BOOK II.

PART THE FIRST.

ACQUIRED DISEASES FROM INORGANIC AND ORGANIC POISONS.

CHAPTER I.

ACQUIRED DISEASES FROM INORGANIC POISONS.

The inorganic poisons which produce diseases in man are of two classes, the solid, which are more or less soluble, and the vaporous or gaseous.

Disease from Arsenic.

The salts of the metal arsenic, so much used in the arts, are causes of at least two kinds of disease: one directly affecting persons who are working in arsenic, as in the making of artificial flowers, ornamental papers, cards, paper-hangings, dresses of ladies, and candles: the other affecting those who occupy rooms, from the walls or other parts of which particles of arsenical poison are being diffused into the air. The first may be called the acute, the second the sub-acute or chronic type of arsenical disease.

Acute arsenical disease.—The acute type of arsenical disease has been described as a form of phthisis pulmonalis, or consumption of the lungs, caused, it was believed, by the direct absorption of arsenical dust. When the disease occurred it was thought that the absorption must have taken place through the pulmonary surface, but the death, some years since, of a girl who was engaged in making artificial flowers led to a modified view. On that occasion Dr. Hassall showed that the local action of the poison on the skin is directly injurious. The green powder, diffused through the work-room, settles on the head, face, neck, and hands. The hands, Dr. Hassall stated, become stained of a green color, which no washing will remove. At length ugly-looking sores appear on various parts of the body, including chiefly the exposed parts, and there is constant soreness of and running from the eyes. The chest and throat are sore, and there is cough. Finally, from the irritation extending from the throat along the alimentary canal, there is irritation and pain of the stomach, diarrhœa, and absorp-

tion of the poison, attended with all the symptoms of acute arsenical poisoning.

Dr. Hassall pointed out, further, that ball dresses colored with arsenical pigment are a source of danger to the wearers of the dresses as well as to the manufacturers of them, and I also collected some cases of disease, induced by the absorption of arsenic, amongst wearers of artificial flowers colored with arsenical pigments as well as among artificial flower-makers. My experience is to the effect that although absorption may be by the skin the danger is most frequently developed through the lungs and throat, the arsenical substance being apparently absorbed by the mucous surfaces. The more serious disease to which the workers are subjected is commonly called consumption, but it is not a consumption of the ordinary kind, although it is attended with wasting and sometimes ends fatally. It is accompanied by that remission of fever and flush of the face, to which the name of hectic is commonly applied, but it is rarely accompanied by spitting of blood, and it often proceeds a long time without any cough, except the throat cough which springs from irritation at the back of the throat. There is also, as Dr. Hassall describes, irritation of the membrane of the nose and of the eyes, neither of which symptoms are necessarily connected with consumption. In the end, the sufferer, if removed from the work in time, may make a fair recovery, which would not be the case if attacked with true tubercular consumption.

In some parts of the paper-staining process, the dust of arsenical coloring compounds is thrown off. This dust, dissolved in the mucous secretions of the mouth and throat, is swallowed into the stomach, and sets up the irritative symptoms of slow arsenical poisoning, viz., pain in the stomach, redness and soreness of the throat, and irritability of the skin. I have seen one instance of this kind, where the symptoms amounted to a modified form of gastro-enteritis. In the mildest of these irritative states of the mucous membrane there is created a persistent dyspepsia, so long as the excitant is at work.

Arsenical salts are employed for the preservation of some organic substances, as, for instance, for the preservation of the skins of animals, and, under some circumstances, where the preserving process is not carried out with proper skill, minute particles of the salts are thrown off, float in the air, and so become inhaled.

I have twice seen symptoms of arsenical irritation produced in this manner in a person who had the dusting and cleaning of stuffed animals, in a close and badly-ventilated museum.

Subacute arsenical disease.—Some painful affections have been traced to long but less severe exposure to arsenical gases or arsenical particles. The symptoms thus excited are of a class analogous to those above described but in a modified form. They are symptoms of chronic catarrh or cold affecting the mucous membrane of the eyes and of the whole bronchial pulmonary tract, the nostrils, the throat, and the bronchial surface. It has been assumed that the skin may also be affected with eruption of a squamous or scaly character from the same cause, and some observers have traced out a series of nervous affections more or less severe, and often obscure.

About twenty years ago a dispute arose in the world of science on the question whether arsenic could be distributed through the air, in minute particles, from walls covered with arsenical papers, and so become poisonous. On this important point an experimental inquiry of a very conclusive character was conducted by Professor Abel. In the experiments which Abel carried out, a large tube was filled with slips of arsenical paper-hangings and the tube was placed in a room, the temperature of which was raised to 90° Fahr. Through this tube air was constantly drawn by means of an aspirator, and was collected in test solutions. The experiments were exceedingly varied, the paper holding the arsenic being in some cases roughened and in other cases treated with paste in a state of decomposition. The air was made to pass over the arsenical surface for periods of nine days. The result of all these experiments was that not a trace of arsenic could be detected in the solutions; neither were any particles of arsenic mechanically carried over.

In a further experiment six hundred grains of finely powdered Scheele's Green were uniformly dispersed through a quantity of cotton wool sufficient to fill, compactly, a tall jar of a gallon capacity. A tube, charged with cotton wool and connected with a test apparatus, was passed to the bottom of the jar, and air was drawn through the apparatus continuously for one week, the jar being placed in a temperature of 90° during a portion of the time. Not a trace of arsenic was found to be volatilized at the conclusion of this experiment.

For many years these experimental facts led to the conclusion that arsenical particles can only be diffused in the air when the surface containing the arsenic is very rough, so that the arsenical colors are loosely attached. At the same time, a great deal of evidence was collected by different observers, indicating that symptoms of arsenical poisoning were produced in persons who were exposed to arsenical surfaces of a smooth kind, and even after such surfaces had been submitted to varnish. These observations led Dr. Hamberg of Stockholm to suspect that the arsenic might escape in the gaseous form, that is to say, in the form of arsenide of hydrogen. To learn if this was the fact, he drew the air of a room that was papered with a light-green colored paper through refined test solutions. The color of the paper had undergone a gradual alteration: one part of the arsenious acid had been oxidized to arsenic acid, while another part had been reduced and had been combined with hydrogen, which being volatile was passing off as a gas, and which he detected in his experiments.

We may gather, then, in considering the action of arsenic upon those who are exposed to it, the probable fact that those exposed inhale, during the exposure, the gaseous arsenic, or, speaking more correctly, arsenic in the gaseous state, in combination with hydrogen. This explanation accounts for many of the facts that have been observed, the arsenical gas being poisonous in such minute proportions, that even to work with it in the laboratory requires considerable care on the part of the worker.

M. Delpech points out various details of facts relating to the effects produced by the inhalation of arsenic derived from the dead bodies of animals that have been preserved by arsenical preparations. He finds that dead animals which have been preserved with Becœur's arsenical soap, and afterwards collected in large numbers in a Museum, charge the dust of the room with arsenic in such proportions that it can actually be removed from the air and proved by analysis. He too believes that surfaces covered with Scheele's Green may yield arsenical gases, developed by the reaction of the arsenious acid upon the organic compounds with which it comes in contact, and that these gases, mingling with the air, infest it and make it a source of danger. He adds, in relation to the practical bearing of the subject, many facts demonstrating that people who live habitually in rooms in

which large numbers of dead birds and mammals are preserved by arsenic, are subject to symptoms of arsenical poisoning.

In the instances of disease from inhalation of arsenic which have come under my own observation, the evidence of the action of the arsenic was definite enough. But the extreme organic nervous symptoms of convulsion and partial paralysis which have been sometimes described as common to poisoning from slow inhalation of arsenic, have not come so clearly under my own observation.

Dr. Leonard Sedgwick has noticed symptoms of arsenical irritation occurring in members of a family who occupied a room decorated with blue paper, in the preparation of which arsenic had been used.

Disease from Cadmium.

In the year 1817 Stromeyer discovered the metal known as cadmium in oxide of zinc, and it has since been obtained from calamine and other compounds of zinc. It exists as a native compound, as the sulphide, in what is called Greenockite, in Renfrewshire, and some of the compounds of it, the green sub-oxide especially, and the sulphide or cadmium yellow, are used in the arts as pigments. Some of the salts of cadmium have been applied to medicinal purposes, and are found to have an emetic action, but their use is comparatively limited.

The white carbonate of cadmium is said to be used in the form of a fine powder for the purpose of cleaning or burnishing plate, and from the absorption of this powder symptoms of a very serious character have occurred. Dr. Sovet published the first account of these phenomena. He records three cases of accidents from the use of cadmium in the manner described. The symptoms observed, brought on from the absorption of the powder used in cleaning plate, were well marked, and were of a choleraic character. They consisted of giddiness, followed by difficulty of breathing, and afterwards by vomiting and diarrhœa. There was great exhaustion, and severe cramps in the legs. Recovery took place in every case.

Diseases from Lead.

Lead as a source of disease affects those who are engaged in painter's work, pottery works, lead works. It also sometimes affects through water that has been carried through leaden pipes.

The diseases induced by lead are of two kinds, acute and often transient; slow and entirely disabling, or fatal. The first or transient form consists of symptoms of intestinal spasm, *colic* as it is commonly called; the second of *paralysis*. I have seen, but this is of rare occurrence, an intermediate disease, in which the internal spasm, succeeded by fever and by the extrication of an extreme fetor from the breath, has ended in a paralysis from which the sick man has recovered without other symptoms. Occasionally the spasm of the intestines, colic, ends in death; but, as a rule, there is perfect and often rapid recovery from this symptom.

The paralysis from lead is sometimes determinately serious from the first, and is so distinctive that the term "saturnine paralysis" has been applied to it. It is in some respects like that form of paralysis from alcohol which has been compared with the general paralysis affecting the insane. It differs from this and from other paralytic affections in many respects, notably in the following particulars—

(1) It attacks most frequently the muscles of the upper limbs. This is so commonly the case that Tanquerel affirmed he had only seen the lower limbs involved in one case out of one hundred and two. His experience is exceptional. I should place the occurrence of general paralysis, involving the lower limbs, after paralysis of the arms and hands, at one in eleven. Still it is the broad fact that the muscles of the hands and arms are those in which the failure of power appears first, and that the failure in a large majority of instances is confined to these parts.

(2) In this paralysis the extensor muscles, the muscles by which we extend the limbs, are first and most seriously affected; hence the origin of the condition known as "drop wrist" from lead, in which the extensor muscles lose the power to lift the weight of the hand. Later in the course of the disease, the same deficiency extends to the muscles that raise the limb altogether. The loss of power which is induced is due, in the first instance, to failure of nervous stimulus from those nervous centres which direct and excite the muscles of the upper limbs of the body to motion. There is no doubt that all the muscles of the limbs are paralyzed; but, as relatively, the group of extensor muscles is less powerful as it is less massive than the group of flexors, the extensors are those in which the enfeeblement is first discovered and continues longest.

Many investigations have been made to determine the mode in which the lead poison acts in causing the paralytic state; but in this direction little that is definite has been revealed. In what form of chemical combination with the tissues the metal lead is fixed has not been determined; all that is known is that the metal is distributed largely through the body in the cases under notice. It has been found in the liver, the blood, the nervous substance, and the muscles of those who have died from it; but how it is combined in those parts is not ascertained. The nearest approach towards an explanation is, that as a salt of lead it acts on the albuminous parts of the tissues, coagulating them, and becoming itself combined with the solidified structure. In this way the activity of nervous action would readily be cut off; but why particular parts of the nervous system should seem to be involved in preference to other parts is difficult to answer. After a period of inaction from lead paralysis, the muscles waste, they become of fawn color and shrunken. From this state they never recover, and when the heart, which as we know is a muscle, is involved, the sinking into death is inevitable. Lead paralysis becomes hereditary.

While the patient is suffering from the influence of this simple but potent poison, other parts of his body, besides the muscles and nervous centres, undergo organic changes. Along the gums a deep dark blue line extends, which specially indicates the action of the metal. The line is narrow and may present different shades of color, varying from a light leaden hue to a dark blue or purple. The darkened surface is very sensitive, and if pricked gives out dark fluid blood. The structure affected is rather firmer than is natural, and shows signs of shrinking. The line is produced by lead in combination with a compound of sulphur, and indicates that the system at large is under the influence of lead poison. The visceral organs, the liver, the kidneys, the lungs, show a reduced nutrition and shrinking of their tissues.

It is assumed that lead enters the body in various ways, according to the mode in which it is presented. By those who are working with the oxide of the metal it may be inhaled as fine dust. By those who are working with it in the form of paint, painters, and by those who use it in solution, potters, it is supposed to enter by absorption through the skin. When it is taken through water it is absorbed by the stomach. From what I have gathered from

workers in lead in all departments, I am inclined to the opinion that absorption by the stomach is the most common source of danger.

The potters find that solutions of lead may be applied freely over the external surface of the body without producing effects of a deleterious kind, and I have had convincing evidence of this from men who have worked in solutions of lead for years and have never shown a sign of lead-poisoning. The evidence, on the whole, is strong, if not conclusive, that in most cases of lead-poisoning the poison is swallowed by the mouth. The workman or workwoman, becoming careless after a time, takes up bread or other articles of food with hands soiled with lead. Thus a little lead is taken daily, and in time the mischief is done.

It is one of the peculiarities of this agent of disease, lead, that it is, what is designated, a cumulative poison. Some injurious agents are so soluble they are readily carried out of the body when once they have been received into it. They accompany the excretions, and at brief intervals make their escape. Other foreign and injurious substances are of organic character; these are decomposed or broken up in the chemical processes that go on within the body, and so are eliminated. But lead, an inorganic and sparingly soluble substance, is thrown off with great difficulty. Its chief mode of exit is by the excretion from the kidney. For a time this mode of elimination is sufficient to prevent the general poisonous effects of the lead from becoming active; but at length the action of the poison upon the kidney is to cause chronic inflammation in it, *nephrosis*, as it is called, with destruction of the delicate mechanism of the organ and imperfect function. Then, the mode of escape cut off, the poison commences to accumulate in the system and disease is established.

Disease from Mercury.

In past days persons were often medicinally subjected to mercury until they were affected with swelling of the salivary glands, profuse salivation, and extreme depression. Under this condition the teeth are also affected, there is inflammation of the connecting membrane between the teeth and the alveolus, swelling of the gums and great pain, followed by loosening of the teeth in their sockets, and absorption both of the tooth structure and of the

alveolus. The teeth are left loosened and become necrosed or killed.

These calamities have practically ceased, but others from mercury still occur. Salts of mercury are employed in preserving furs and skins, and from these the poisonous particles of the metallic compound are given off. In this manner packers of furs are affected, sometimes very seriously. A man, thirty-two years of age, so affected, was admitted into Guy's Hospital in December, 1863, under Dr. Owen Rees. He had been engaged four years in packing the skins of animals that had been prepared with an acid solution of mercury and then dried. Until the skins were perfectly dry he had nothing to do with them. His duty was to pack them afterwards. He was salivated for three months, recovered, and remained in good health until twelve months before he was admitted into the hospital. At that time his hand became unsteady, and he could not shave himself; a little later he lost power in his limbs when standing or moving, and afterwards began to have twitchings and tremors when in bed. Soon he was unable to walk without assistance, and a day or two after admission into the hospital he was seized with delirium. He became paralyzed and unconscious, and died within fifteen days from the time of his admission. The mercury was detected in the organs of this man.

The workers at mercurial mines are still subject to the danger of mercurial fumes, especially when they are engaged in the outside works, preparing and subliming mercury.

The disease excited by the fumes varies according to the mode in which they are inhaled. The most frequent symptoms are salivation and ulceration of the mouth. In some instances the stomach is first affected; there is pain in the stomach, constriction, sleeplessness, and cough. These signs are followed by those of salivation; and in some examples, first observed by M. Ferrand, there is a red rash on the body, like the rash of scarlet fever, which lasts for several days, and leaves rheumatic pains in the limbs.

In yet another class of cases the symptoms are more purely nervous, and are those of neuralgia, accompanied or followed by muscular tremor, called, significantly, mercurial tremor. The whole muscular system is, in fact, thrown into constant feeble contractions and relaxations, over which the patient can exert no control.

In the extremest forms of disease from mercurial inhalation,

the teeth become carious, and even the bones are affected. Some idea of these varied forms of disease may be obtained from the facts that have been collected at Idria in Austria. Here there are the second best mercurial mines in Europe, and over five hundred men are employed at them. The works for smelting and purifying are about a mile from the mines, but the men change about so that all are equally engaged at the various parts of the works. In one year Dr. Hermann found that of five hundred and sixteen men thus employed, one hundred and twenty-two were attacked from the mercury, with the following forms of disease: Twenty-seven had neuralgia; fourteen rheumatism; six tremors; sixteen salivation; and two caries. Hermann states that in the valley of Idria all the people, and even the domestic animals, are liable to be attacked with mercurial disease in one or other of its phases.

Disease from Potassa Bichromate.

Of late years, since bichromate of potassa has been used so largely in the arts, certain remarkable affections have been observed as occurring from it. They have been presented under two conditions, namely, during the manufacture of the salt itself, and during the use of it, in the form of solution, in water.

Bichromate Ulceration.

The first observer who specially detected disease arising from the bichromate, was a French physician, Dr. Bécourt. By an accident Bécourt met with a man who was engaged in a manufactory of bichromate of potassa, and who was suffering from a peculiar kind of ulceration in the face. The case was studied by Bécourt in consultation with the distinguished hygienist, Chevalier, and they both came to the conclusion that the bichromate of potassa was probably the cause of the disease. They failed to obtain from the man, however, any such particulars as they could consider satisfactory; they therefore looked in other directions for more knowledge. After a time they obtained from the director of a manufactory at Graville the information that many of the workers in the manufactory were subject to a peculiar form of ulceration.

In transforming neutral chromate of potassa, by means of chromic acid, into bichromate, the vapor arising carries with it

an infinity of pulverized molecules of the product which spread through the workshop. A cloud of particles is easily visible in a ray of sunlight. The particles, if inspired abundantly, give to the palate a bitter and disagreeable taste; but, as saliva is profusely produced, the chromate is thrown off and has not time to inflict injury.

If, instead of breathing by the mouth, which for long periods of time seems impossible, the particles are drawn in by the nose, great irritation of the delicate membrane lining the nose is produced, there is a violent sensation of pricking, suffusion of tears, and irresistible sneezing. There follows upon this ulceration of the septum of the nose,—the partition that divides the nostrils,—and ultimately the septum is destroyed altogether and lost. Upon this the symptoms cease, and the workmen, as a rule, continue steadily at their employment without further suffering.

Chevalier and Bécourt are of opinion that this process of ulceration of the nose is not produced in those men who take snuff.

The same observers noticed that if the skin of the body be unbroken, it may be exposed to a strong and even to a heated solution of the bichromate, or may remain for many hours in actual contact with the salt itself without any bad effect. But if the skin be torn, or abraded, or cut, and the salt be left in contact with the wound, the caustic action is so intense that severe inflammation follows with decomposition of the living tissue. The caustic action is so great it does not cease until it has penetrated to a bone. The pain of the ulceration is excessively severe. They also observed that when a moist surface of the body is exposed in creases or folds to this salt, a peculiar irritability and itching is set up. This is unattended by ulceration if the part be not abraded by rubbing, but, under abrasion, a troublesome and very painful ulceration occurs.

M. Clouet, a manufacturer of bichromate of potassa at Havre, has added to the above facts others which are of great importance in their practical bearing. He shows that the inferior animals suffer from the effects of the bichromate as severely as man. Horses employed in the manufactory, and which walk over the bichromate salt, are attacked in the feet; the hoof falls off, and the ulceration extends to the upper part of the leg. In one instance of this kind, recorded by Chevalier and Bécourt, a horse was attacked in one of its hind feet, and was quite disabled. The ulcer

ation extended through the limbs and through nearly half the body of the animal, and death occurred within a month of the commencement of the malady. Both legs on the affected side were entirely ulcerated. It was as if the decomposition, when it had commenced, went on indefinitely as a veritable metamorphosis of the skin and flesh altogether, analagous to a fermentative action. Dogs and cats and rats were discovered, in the manufactory, suffering in a similar manner.

Bichromate of potassa taken internally by the mouth is a purgative, and in large doses of from fifteen to twenty grains is poisonous. It causes severe colic and purging, but no vomiting. M. Clouet, to whom we are so much indebted for information on this subject, and who first made observations respecting the internal action of the bichromate, states that in one manufactory some workmen inflicted the foolish and practical joke of putting bichromate of potassa into a barrel of cider belonging to certain of their fellow-workmen. The cider was rendered of a dark color, but, notwithstanding, the workmen drank of it, and were all affected with severe colic and diarrhœa, from which, happily, they recovered.

Bichromate Pityriasis.

I have been unable to trace ulceration from the bichromate in England. But amongst English operatives I have recently observed a series of facts illustrative of the action of a watery solution of the bichromate on the skin. In that part of the autotype process in which a solution of bichromate, containing from three to five per cent. of the salt, is employed, some of the workers with the solution are affected by an irritation which extends over those parts of the hands and arms that are exposed to the irritant. There is at first a redness, erythema, over the parts affected, which is followed by a considerable amount of irritation, with raised spots, ending in a reddish, scaly exfoliation of the upper skin, very much like what we have already studied under the head of pityriasis rubra. The eruption passes away in a few weeks after the hands and arms are no longer exposed to the solution, and the disease never extends deeply unless there be a sore or wound of the skin. Some workmen suffer much more severely than others, and are much longer before they make a recovery. A few escape altogether, and that even though their skin be of delicate texture.

Disease from Potassium Cyanide.

Serious symptoms are sometimes produced from the absorption of cyanide of potassium by those who are engaged at work where solutions of this substance are employed. The danger affects those, specially, who are engaged in photography. It seems to arise from direct absorption of the poison by the skin, but only when the skin is wounded, abraded, or chapped. My attention was first called to this subject by a photographer, who consulted me for a series of symptoms with which I was not familiar, and which could not be accounted for by any evidence leading to the suspicion of organic nervous disease. The symptoms only came on when he was at his work, but they lasted for some hours after he had left his work. I suspected they might be due to the inhaling of the vapors which are present in the working-room of the photographer; but this theory was excluded by the fact that he had worked for many years in the same place without being affected, and that none of the workmen who were in the room with him were similarly affected.

These circumstances led me to look out for local absorption by the skin. I found that the hands of the man were severely chapped, and that they had been so on every occasion when the phenomena recurred; for the phenomena were repeated many times before their cause was discovered. I was now on the right track, and by directing him to give up that part of the employment which involved exposure of his chapped hands to the solution, the patient experienced a quick cessation of his symptoms, and recovered from them without any recurrence.

The symptoms are exceedingly characteristic; they begin with vertigo. A sense of giddiness is gradually developed, with a sensation as if all objects were passing in a circle, and then as if the body of the affected person were turning round. At times there is a further sensation of falling, as though, of necessity, the body must pitch forward, and as if the lower limbs were unable to support the weight of the body. These symptoms may last for some hours, and if they are not exceedingly severe they will subside when the work of the day is over, and will not recur until the resumption of labor on the following day. They may be entirely misunderstood, and indeed often are misunderstood. In their lighter manifestations they are attributed to biliousness, or to in-

digestion. When they become more severe another symptom is added; the giddiness or vertigo is attended with nausea and faintness, so that it is impossible to go on with the work. But even from this more extreme condition recovery is rapid after exposure to the cause ceases.

Under still further exposure the body becomes cold, and an extreme shivering takes place, which is succeeded by a prostration that altogether incapacitates from work, and is connected with a series of new nervous phenomena of serious moment. The first of these nervous signs is double vision; the patient, that is to say, in looking at a single object sees it as if it were two objects, or as if both eyes were separately discerning the one thing.

Finally, there are muscular tremors which are altogether beyond the control of the will. The tremors do not amount to spasms of the muscles, but they are sufficiently active to cause involuntary movements of the limbs, and they are attended with occasional starts and twitchings. The temperature of the body is lowered, the appetite is greatly reduced, the secretions are confined, the face is pale, the action of the heart is quick, weak, and irregular, and the sense of exhaustion urgent. The mind throughout is unaffected, but there is, perhaps, an unnatural tendency to sleep.

The poison being soluble finds its way out of the system with moderate rapidity, and thereupon all the severer symptoms are removed, but some remain for several weeks. The strength returns but slowly; dyspepsia continues as a very troublesome symptom; anæmia is a marked condition; and, the blood, which has been rendered very fluid, escapes too freely from wounded surfaces.

Some examples of poisoning by the local absorption of cyanide of potassium have been recorded, in which symptoms still more alarming than any I have seen have followed upon the accident. One remarkable case of this kind is given by Dr. Davanne. A gentleman who had stained his hand with nitrate of silver endeavored to remove the stain by rubbing it very freely with cyanide of potassium. In this process he slid under the nail of one of his fingers a small portion of the cyanide salt. At first he did not notice what had happened, but in a little time he felt a severe pain in the part, which after a few minutes was followed by an intense vertigo, so that all objects appeared to be moving around him. To relieve himself, promptly, he conceived the idea of

washing the part freely with vinegar. The vertigo now increased, was accompanied by shiverings, extreme pallor, complete loss of sight, and entire prostration ; even the power of speech was lost, but the intelligence was, throughout, preserved. The limbs were very cold, and as the sight returned the phenomena of double vision were manifested. These alarming symptoms were not altogether removed within a period of ten hours, but recovery ultimately took place.

Disease from Salts of Silver.

When some of the salts of silver, the nitrate especially, are brought into contact with the skin, with moisture, they produce a dark stain, which, ordinarily, is only of temporary duration. If the salt be taken internally in small quantities, and for a considerable time, the whole of the surface of the skin becomes dark in color. The discoloration or stain is fairly distributed over the surface, but is most marked in those parts of the body which are exposed to light, as the face and hands, in which parts I have known the stain to be as deep as the complexion of a mulatto. The discoloration gradually lessens in the course of years, and it may be somewhat reduced by medical art, but I have never known it pass away entirely.

Disease from Zinc.

Men engaged in bronze founding are subject to serious symptoms from inhaling the fumes of oxide of zinc. The fumes rise to the mouth of the workman and settle on the lips, causing sometimes a whitish efflorescence. After long exposure to these fumes choleraic attacks are induced, with shiverings and severe cramps in the muscles of the legs. Vomiting is induced, and the food taken undergoes a peculiar fermentation, causing water-brash. Zinc-plating and the manufacture of "corrugated zinc" are also attended with most pernicious results to health.

Disease from Sodium Chloride,—Common Salt.

Seafaring men, and others who have lived for a long time on salted foods, are subjected to an induced disease called commonly "sea scurvy," but which is more correctly defined as "saline

purpura," inasmuch as it depends on the action of the salt which is taken with the food. The physical change induced consists of a modification in the state of the blood. The specific weight of the blood is unduly increased, the plastic constituents of the blood are held in too extreme a state of solubility, and the corpuscles are reduced in size and made irregular at their edges. The effect of these changes is to render the blood so fluid that it pours out of a wound or into the soft tissues with unnatural readiness. From such parts as the gums the blood exudes freely. It infiltrates into the skin, causing dark vascular blotches, purpuric spots, and, sometimes from a wounded surface, or even a weakened vascular surface, it flows so freely that danger of death from the loss of it becomes imminent. In addition to these changes there follow indirect modifications in other organs, owing to the readiness with which, in its unnatural saline condition, the blood attracts and condenses water. The nervous centres suffer in consequence, and extreme prostration is the result.

Disease from Copper.

The salts of copper are sometimes productive of disease, the acetate being the most commonly offending substance. Food retained in copper vessels has become poisoned, and peas, beans, and other green vegetable products boiled in contact with copper, for the purpose of increasing or preserving the green color, have also been rendered poisonous. The symptoms are choleraic in character, and attended with severe irritation of the stomach and bowels. When the dose taken has been large, collapse and fatal exhaustion have supervened; or, the acute symptoms having subsided, long-continued irritation and even ulceration of the mucous tract of the intestinal canal have set in, followed by slow and imperfect recovery.

CHAPTER II.

ACQUIRED DISEASES FROM INORGANIC GASES AND VAPORS.

By a gas is meant a substance which is ordinarily known to us in the gaseous form of matter, like the air we breathe. A gas is incondensible into a liquid or solid under the ordinary atmospheric pressure, at common temperatures.

By a vapor is meant a more readily condensible aeriform fluid which has taken that form from a liquid or solid, under the influence of heat, and is diffused in the air. It is usual to speak of a vapor as being derived from the volatilization of some volatilizable body like water-vapor,—steam,—from heated water.

Sometimes gases or vapors, given off from various substances, are called fumes. The vapors given off from heated resin, from phosphorus which is being oxidized, from mineral acids, such as the nitric or hydrochloric, are commonly called fumes. I prefer to speak of them as gases or vapors.

Gases and vapors when inhaled pass, like the air, into the windpipe and lungs. Diffused with the air, they may reach the blood which has been sent from the right side of the heart to the lungs, and absorbed by it may enter the blood-stream and condense in it. They have, therefore, a general as well as a local action.

Disease from Ammonia Gas.

In many industrial occupations ammonia gas is liberated in free quantities. In the process of felt hat-making shellac is dissolved in a weak solution of ammonia. The felt is then steeped in the solution, and the ammonia, volatilized by heat, charges the atmosphere with its vapor. In other occupations ammonia is liberated in the decomposition of ammoniacal salts. In a third class ammonia is given off from decomposing organic compounds. In all cases the workers are exposed to the ammoniacal gas.

Considerable difference of opinion exists on the question of the harm that is inflicted by the inhalation of ammonia. Some observers have arrived at the conclusion that the gas inflicts no injury, and I am of opinion that the injury is much less than might at first sight be supposed. When, however, the inhalation of ammonia is long continued, certain physical effects result which must be considered injurious. The blood is rendered unduly fluid, the corpuscles of the blood are changed in form and are made crenate, the oxidation of the blood is reduced, and the disease anæmia, which has already been described, is developed.

There are some occupations in which decomposing organic remains are present, and which yield to the air of the place where the labor is carried on an ammoniacal sulphur odor which is most offensive, and which even taints the clothes and person of the worker. Those who are engaged in the labor of making catgut strings and cords; those who are engaged in dressing skins into rugs, as fellmongers; and those who act as bone-sorters and boilers are specially subject to these odors. A woman who was engaged in the first of these occupations, and who came to a public dispensary, to which I was physician, for medical advice, was so offensive she could not be tolerated in the waiting-room with the other out-door patients, and she had to come in after all the rest had gone. The odor from the fellmonger's yard and from the bone-boiler's premises is detectable even at long distances from the place. It would be assumed, at first thought, that the operatives, breathing for many hours every day such an atmosphere, must needs suffer from some marked disease. I am bound to say that the evidence in support of this suspicion is all but negative. I have been unable to discover any definite symptom of disease connected with these callings as the result of the labor. Neither can I find any statistical facts that illustrate an unusual mortality from such labor.

Disease from Carbon Bisulphide.

Of late years the very disagreeable volatile fluid, known originally as the alcohol of sulphur, then as sulphuret of carbon, and now as carbon bisulphide, has come into great use in various industrial pursuits. It is employed for taking grease out of wool; for extraction and purification of paraffine; for extraction of oil

from oil-cakes when pressure is of no further use; for draining the sawdust used in refining oil by filtration; for extracting grease from bones or kitchen refuse; and for extracting aromatic essences and perfumes from plants. But the most important use of carbon bisulphide is, perhaps, in the manufacture of caoutchouc articles, toy-balloons, and water-proofings. In making toy-balloons the bisulphide is used to dissolve the caoutchouc and bring it into such a state of softness as will allow it to yield to the blast of air from the bellows. In water-proofing, it is used for the varnishing with india-rubber. The peculiarity of the bisulphide of carbon is, that on its volatilization the substance dissolved in it is deposited, while it, itself, diffuses in vapor through the air.

The action of this vapor on the workmen was originally described by M. Delpech to the Academy of Medicine of Paris, on January 15th, 1856. The effects are peculiarly severe. They consist, first, of acute symptoms of anæsthesia, with intoxication, which afterwards become chronic. The head is much affected at all times, and partial insanity is not infrequent. The taste is vitiated; the sight and hearing are troubled; the digestion is perverted so that the appetite is increased, even to gluttony, and there is persistent nausea. The breathing organs, the organs of the circulation, and all the secreting organs are deranged, and such enfeeblement results that the workers, so long as they continue at their work, are simply wretched.

No name can be found for this particular disease in the old classification of diseases. It is, in fact, a malady, *sui generis*, from which the victim of it suffers so long as he labors. The symptoms include derangement of mind as well as body. The disease approaches most nearly to the general paralysis of the insane, and we may classify it as *cerebral paralysis.*

Under an improved hygienic system, including better ventilation of the factories in which the bisulphide of carbon is used in the arts, the resultant dangers from its use, above described, have been greatly reduced during the last few years. They are not, however, as yet entirely removed.

Disease from Carbonic Oxide-Gas.

Carbonic oxide is the product of the imperfect combustion of carbon in oxygen. It is produced in large quantities whenever charcoal or coke is burned in common air, as is so often done in

the chafing-dish and stove in various industrial occupations. The gas is inodorous and most poisonous. I found by direct experiment that one part in three thousand of this gas produced, by inhalation, extremely dangerous symptoms, namely, giddiness, drowsiness, unsteady movements of the heart, tremulous and convulsive movements of the muscles, and nausea. I also discovered, some years ago, viz., in 1862, the curious fact that prolonged breathing of this gas, in minute quantities, gives rise, temporarily, to the disease known as diabetes.

Amongst the industrials exposed to carbonic oxide, certain of the symptoms I have named are frequently induced when the workers use burning coke in a closed room. I have found tinmen and braziers suffering from this cause, and the influence of the same is felt by walking-stick makers and all others who are obliged to stand over the fumes of incandescent coke. After a time the body seems to become, to some extent, accustomed to the gas, but the bad effects are not therefore mitigated, though they be less severely felt. The chief symptoms complained of may be summed up in the one word vertigo. The sufferer tells you he is giddy, that he feels cold, and that his hand becomes unsteady at his labor. He leaves his work for a time, enters into a better atmosphere, obtains relief, and returns to his work again to feel the same symptoms. In the case of a brazier who worked in a small close shop, and who kept a chafing-dish at all times on his bench when he was using heated irons, the symptoms were at first those of nausea, which passed even to vomiting, flushing of the face, giddiness, as if he were spinning round, and faintness. He became inured to some of these symptoms after a time, but lost appetite, and said he could not help feeling giddy, do what he would, until he was out of doors. Things seemed to be moving before him, and his hand was unsteady. An improved system of ventilation, with a shaft for removing products of respiration, put a stop to these dangers, but he suffered for a considerable time after the cause was withdrawn.

The women who work at the lace frame suffer from carbonic oxide under some circumstances. In cold weather they are led to place a chafing-dish of burning coke beneath the frame, and directly under their own nostrils, the object being to keep their hands warm for the performance of their work, which requires delicacy and precision of hand movement. In this way the women

are made to breathe an atmosphere charged with carbonic oxide, from which they suffer severely, at first with acute, afterwards with chronic symptoms. The acute symptoms are headache, giddiness, nausea, faintness, flushing of the face, and irregular action of the heart. The chronic symptoms are, failure of appetite, fetor of breath, a nervous, hysterical condition, and anæmia, with great depression of muscular power.

It has not as yet been ascertained whether the disease diabetes has actually been excited in those who work in an atmosphere containing carbonic oxide, but it has been observed, in corroboration of the experimental evidence I before mentioned, that some men exposed, by accident, to the gas were rendered diabetic for a period after their recovery from the narcotic effect and from the other immediately dangerous conditions into which they had been cast. Carbonic oxide forms a part of all coal gas, existing in the purest coal gas in considerable proportions—7.85 per cent. It thus becomes diffused, in small quantities, from the burners into the air of badly-ventilated rooms and shops in which gas is largely employed for lighting and warming. I believe that in this manner carbonic oxide is a common cause of nervous derangement and dyspepsia.

Carbonic oxide is the chief cause of the headache, nausea, and giddiness which are experienced whenever coal gas is directly escaping into rooms where it is introduced for lighting or heating purposes. Carbonic oxide also escapes, sometimes, from badly constructed furnaces and poisons the air. An instance of this, described by the late Dr. John Davy, took place in a church at Ambleside, and caused serious illness to large numbers of the congregation.

Disease from Chlorine Gas.

Workers engaged in the manufacture of chloride of lime are exposed to chlorine, one of the most fatal and dangerous of gases. At the works where chloride of lime is made chlorine is conveyed into chambers or rooms closely vaulted in. The chambers are lighted by strong panes of glass which, firmly inserted in the wall, are just sufficient to allow the yellow color of the chlorine in the chamber to be seen. Within the vaults are shelves on which lime is laid before the chlorine is admitted. Then, the vault

being closed, the chlorine is allowed to enter and remain in contact with the lime to form chloride of lime.

When the change is complete the doors of the vault are opened, and the workmen enter to remove the chloride. They wrap round their mouths large shawls or towels saturated with water before they enter, and they come out, frequently, to breathe fresh air. The water in the towels absorbs much of the chlorine, and direct risk is in this manner saved, but they rarely escape some risk, and often come out with great oppression of breathing and irritative cough. They suffer also from irritation of the conjunctival membrane of the eye, caused by the gas, and they use this irritation as a test of the endurability of the atmosphere within the chamber. If the eyes do not become irritable they feel safe in continuing at the occupation.

It seems clear that after a time the workers tolerate the inhalation of chlorine to a considerable extent and, from this cause, suffer much less than would at first sight be expected. Nevertheless, in all I have examined,—and I once had the opportunity of carrying out an extended examination,—I found no chlorine workers who were free from affection of the lung. They all presented signs of bronchial affection, with anæmia, and they all complained of occasional paroxysms of spasmodic breathing. The healthiest one amongst them was pale, with purple congested lips, indications of frequently distressed breathing and permadently impaired respiration.

Disease from Copper Smoke Vapors.

The action of copper smoke vapor, on those who are exposed to it, is to produce asthmatic seizures in the older operatives in addition to a bronchial irritation which it excites in the younger. The smoke is extremely destructive to vegetation. Its influence on vegetation may, indeed, be summed up in one word,—corrosive.

Although the fumes are called copper smoke, the amount of copper in them is minute. One half per cent., only, exists in the deposit in the interior of furnace chimneys, and so little is diffused in the air that none can be detected a few yards from the works, except when the smoke is extremely dense.

The late Dr. T. Williams, F.R.S., of Swansea, from whose analyses we receive the above and the best facts, states that the

products of the smelting operation are divisible into two parts, the gaseous and non-condensible, the solid and condensible fumes.

The fumes which condense in the culverts contain oxide of iron, oxide of lime, and traces of antimony and other metals, with a proportion of about 44 per cent. of pure copper; 5 per cent. of arsenious acid; 10 to 15 per cent. of sulphur; 15 to 20 per cent. of sulphuric and sulphurous acids in combination; 14 to 19 per cent. of water.

The smoke which escapes into the air from the chimneys contains coal smoke in abundance, with traces of arsenic and of sulphurous and sulphuric acids. Williams reckoned that 829,790 cubic feet of sulphurous acid were sent into the Swansea district every week from the copper smelting works adjacent. This acid can be detected in the atmosphere twenty miles from the works. Sulphuric acid is also diffused with sulphurous. For every fifteen parts of sulphurous acid in the smoke there exists one of sulphuric acid in combination. Upon these acids is chargeable the destruction of the vegetation of the district.

The cattle feeding in the locality are affected with a disease termed by the Welsh farmers "Effydrdod." This disease is an inflammation of the periosteum or membranous covering of bone. The bone becomes thickened in the neighborhood of the joints. There is inflammation of the joints with effusion of fluid into them. The bones are prone to fracture. The teeth sometimes fall out and sometimes decay. Williams, whose description is here again followed, attributes the symptoms solely to the sulphurous and sulphuric acids. These acids, brought down by the rain, render the grass sour, and the eating of the grass by the cattle causes the peculiar malady.

Disease from Vapor of Hydrochloric Acid.

In some chemical factories the vapor of hydrochloric acid produces injurious effects, and, to a certain extent, the action of the vapor is felt by men who use this acid for soldering and other mechanical purposes. The symptoms produced are dryness of the mucous membrane of the nose, mouth, and throat, with suffocative cough, and sometimes spasmodic difficulty of breathing. In some workmen considerable irritation of the mucous membrane of the nostrils is induced by this vapor.

Disease from Vapor of Nitric Acid.

The vapor of nitric acid is a source of injury in some occupations. It is experienced, mostly, by those who are engaged in the process of fur-dyeing. The acid is used in this process for two purposes, for freeing the substance of the fur of greasy matter, and for giving a dark yellow or brown stain. The vapor of the acid rises very freely, and is, of necessity, inhaled by the workmen. The symptoms produced are dryness and redness of the throat, constant constipation, and severe pain at the back of the head, with sensation of weight and often with a sense of giddiness.

Now and then in the practice of the chemical laboratory the inhalation of the vapor of nitric acid produces very serious effects. A man who was engaged in my own laboratory once suffered severely from this cause, the symptoms of difficult breathing and cough lasting for several days. In March, 1863, Mr. Steward, a master in the school of the Edinburgh Royal Institution, together with one of the janitors of the school, died from this cause. A bottle of nitric acid was accidentally spilled and the two men inhaled the vapor. Neither of them at the time felt pain; but both died, one in about ten, the other in about thirty hours after the occurrence of the accident.

Disease from Phosphorus.

The introduction of the manufacture of phosphorous, or lucifer, matches, which commenced about forty-three years ago, created a new form of disease, caused by the inhalation of the phosphorous vapors given off from the phosphorus. This disease, an extremely painful one, affected the jawbone of the worker, causing necrosis or death of the bone. It was not detected until the year 1845, when it became well defined in the public hospitals at Vienna. To Dr. Letheby we are indebted for the first light that was shed on the subject in this country. The mischiefs, when they occurred, were all produced by the use of white phosphorus, the common phosphorus of commerce. In the match manufacture the fumes of the phosphorus were inhaled at every step in the process, from the stirring of the mixture, through the dipping, to the boxing of the matches. While the disease was extant I made a very careful investigation of it in respect to its develop-

ment and course, and reported the facts in one of my lectures on the "Medical History of Diseases of the Teeth," delivered in 1858, and published in 1860. The facts, briefly described from that lecture, are that the symptom first complained of was pain, deep seated in the teeth, and having, usually, one tooth for its centre. It was not a toothache, nor was it strictly confined to the particular tooth, but extended steadily and persistently along the lower jaw, and was much intensified when the jaw was gently percussed or struck. In time the disease became concentrated in the jaw; a slow inflammatory process occurred and a thickening of the bone, ending in death of the bony structure, with attempts, in parts, at regeneration. In short, what is called a true necrosis was developed. In the worst cases, where the patient was not relieved by operative measures, hectic supervened, with copious night-sweats, extreme pain, and even death from exhaustion. It was remarkable that no bones except those of the jaw were affected, even in the worst cases, so that the disease was purely local, and, indeed, was disconnected from the other symptoms of phosphorous poisoning. I inferred that the malady was due to a volatile acid of phosphorus, which was absorbed by the saliva, and affected the jawbone whenever the teeth became unsound and the alveolus, or edge of the jawbone, became exposed. This view accounted for many of the anomalies, namely, that the lower jawbone alone was affected, that the enamel of the teeth escaped injury, and that workers whose teeth generally were sound escaped the injury altogether.

When the phosphorus disease once commenced, it continued in progress over periods of one, two, or even three years. It was in some cases so localized in its extent that only the teeth came out; in others it extended through the whole of the bone. I compared it, in 1858, to a chemical destruction of the bone, with inflammation from the irritation produced by the foreign products of decomposition. I see no reason to modify that definition.

In treating of the phosphorus disease, I have spoken of it in the past tense. I have done so because, fortunately, the affection is now all but extinct. The discovery made by Lundstrum, of Sweden, that red or amorphous phosphorus could be applied for the production of matches, led to a complete revolution in the match making business, and to the introduction of what is called the safety match. By this plan the red amorphous and practically

innocuous phosphorus was placed on the box, and the combustible substance put on the match was made of materials that were perfectly harmless to health.

Disease from Vapor of Resin.

Some very simple, and as it would seem innocuous, occupations are attended with bad results from trifling causes. For fixing the tufts of hair of brushes, such as shaving brushes, a solution is made by mixing melted resin with boiled linseed oil. The workman dips the tuft into this solution, and while leaning over it inhales the fumes of resin. Great distress of breathing and irritation are produced by this process. The cough is suffocative, and becomes in time chronic with persistent irritation. Many workmen have to leave the business from these causes, and those who do not actually retire from the occupation are often obliged to rest from it, on account of the chest affections, for long intervals of time.

Disease from Sulphurous Acid Gas.

Sulphurous acid, the gas produced by the burning of sulphur, is used for bleaching purposes, and especially for bleaching straw for bonnets. The plaited straw is brought in lengths to the bleacher. It is first soaked in an alkaline solution of potash or ammonia, and afterwards is exposed to oxalic acid. It is subsequently washed in soapsuds, and, lastly, is bleached by being subjected in a closed chamber to the fumes of burning sulphur. Into the bleaching chamber the workman enters to turn and change the straw. The air is irrespirable, but by learning to hold the breath for one or two minutes, the operator becomes skilful in avoiding a dangerous inhalation of the gas. He rarely escapes altogether from the effects of the gas, and he still feels the effect while the straw is being removed and dried.

The more active symptoms induced by sulphurous acid are those of suffocative cough, which is of short duration upon withdrawal from the gas, and does not seem to lead to any serious bronchial mischief. But after frequent and prolonged exposure to the effects of the gas, the system is influenced through the blood. The blood is rendered unduly fluid, the diseased condition known, technically, as anæmia is developed, and bilious-

ness, amounting even to jaundice, is, occasionally, an added disorder.

In connection with the effects of sulphurous acid, I have found another class of workers who suffer from it in conjunction with effects from another cause of injury. The class I refer to are the "fellowship porters." I discovered in these men, who are employed in landing merchandise, corn and fish especially, that the workers amongst the corn are affected not only by the dust, which is a source of much irritation, but also by the escape of vapor of sulphurous acid which exhales from grain that has been bleached by the acid. Oats coming from Ireland are often bleached in this way, and smell strongly of the gas. The admixture of gas and dust is exceedingly irritating to the lungs, and is a cause of bronchial coughs and spasmodic asthma. The connection of dust with the gas must, in this instance, be taken into consideration as adding very much to the distress, and, probably, as accounting for the bronchial cough and asthmatic seizure.

Disease from Sulphuretted Hydrogen.

In some of the chemical manufactories, and, occasionally, in laboratories, the operatives are exposed, at times, to the action of sulphuretted hydrogen gas, which is evolved in certain processes of chemical decomposition. Workmen in sewers and cesspools are also exposed to the influence of this gas, which is there evolved from the organic decomposing matter.

The gas is an active poison, and death is an occasional result from inhaling it. Diffused in breathing air in the proportion of 1.714 per cent. it is immediately fatal; and in the proportion of 0.205 per cent. it produces insensibility, with feebleness of respiration and muscular tremors. Even when diffused in the minute proportion of 0.056 per cent., it causes, when inhaled, distressed breathing, nausea, giddiness, rapid pulse, heat of the surface of the body followed by coldness, and after symptoms like those of low continued fever.

These primary effects of the gas, though severe when first experienced, pass away after a time, owing to the tolerance for it which seems generally to be set up. Hence in the alkali districts, where the gas is constantly being evolved in most objectionable quantities from the alkali heaps, and where it quickly discolors

fresh animal substances exposed to the air, it appears to affect but little the health of the persons who live in the districts. I devoted some weeks to inquiry on this particular point in the alkali districts, and though at first I suffered severely myself, and was absolutely unable to live in some atmospheres in which the gas was present, I found that those who were accustomed to them breathed them with impunity, and I failed to trace either amongst the young, middle-aged, or old any special form of disease to which I could give a name as dependent upon the action of the gas upon the organism. A similar inquiry, having the same object, amongst persons engaged in the sewers led to similar negative results, although I received confirmation of a fact, noticed by other writers, of an occasional accident of actual poisoning from the respiration of an overwhelming dose.

CHAPTER III.

ACQUIRED DISEASES FROM ORGANIC POISONS.

Diseases from Absinthe.

The substance made and sold under the name of absinthe is a mixture composed of 50 per cent. of alcohol; 0.35 per cent. of oil of wormwood, oil of the *artemisia absinthium;* $2\frac{1}{2}$ per cent. of other essential oils, usually of cloves; $1\frac{1}{2}$ of sugar; and, 45.65 of water.

To give a color to absinthe, the juice of spinach, which contains a coloring principle, chlorophyll, is added in small quantity, by which the liquid is rendered of yellowish green; but the color is not always cared for, and I have seen a specimen of almost amber tint from the absence of green coloring stuff.

The phenomena produced by absinthe in persons who indulge in it are those of alcoholic intoxication, combined with nervous derangement, and a specific epilepsy produced by the oil of wormwood. There is first intense dyspepsia, with dryness of the mouth and throat, followed, if the habit be continued, with destruction of all desire for food, until the appetite has been tempted by the "bitter." This marks the first stage of the disease. In time the nervous system becomes disturbed, and muscular movements cease to be performed correctly under the direction of the will, such irregularity being attended with vertigo and giddiness. This marks a second stage. Later still there is insensibility and epilepsy, with recurrent epileptic seizures up to death.

Diseases from Alcohol.

All the members of the alcohol family, when they are taken into the body in sufficient quantity to produce an effect, excite disease. But, *the* member of the family in this respect is the common ethylic alcohol which enters into the composition of our

ordinary beverages, called spirituous, such as ales, wines, gin, rum, whiskey, brandy, and the like. The number of diseases produced by alcohol have been variously estimated by different writers. The distinguished Dr. Benjamin Rush reckoned twelve diseases from this cause, most of which "are of mortal nature." Dr. McNish reckoned twenty-two diseases from this cause, including, however, certain minor effects, such as foul breath, redness of the eyes, tremors, and palpitation, which should rather, perhaps, be considered symptoms of diseases than diseases themselves. The affections I have myself noticed and recorded may be classified under the following heads.

Dyspepsia from Alcohol.

The dyspepsia from alcohol is one of the first indications of its baneful action. The tongue is coated with a white fur, the appetite is capricious, the skin is often very hot and then very cold, the action of the bowels is irregular, sometimes attended with constipation, at other times with relaxation. The renal secretion varies, being at one time copious and pale, at another time scanty, loaded with a pink, dense deposit, and often coated with a fatty-like iridescent film or pellicle. The sleep is irregular, at times too heavy, at other times absent during natural hours of sleep. The mind is irritable, and the desire for the alcohol grows upon the affected person until the poison seems to be an absolute necessity of life.

Diseases of the Skin from Alcohol.

In those who are frequently under the influence of alcohol the external surface of the body is often affected. The skin becomes easily red and injected, assuming the appearance of *erythema*. The condition shows a relaxed state of the blood-vessels, caused by the action of the alcoholic poison.

The disease of the skin which we have already discussed under the name of *acne rosacea* is very frequently produced by long-continued action of alcohol in persons in the decline of life. This disease shows itself, as it will be remembered, in the vessels and cutaneous surface of the nose.

Diseases of the Heart and Blood from Alcohol.

The heart and other organs of the circulation are affected by alcohol functionally and organically. Whenever a distinct effect is made on the system by alcohol the fact is indicated at once in the motions of the heart. The action of the heart is quickened for a considerable time, and then becomes enfeebled until another quantity of the poison is taken to revive it, a revival which soon becomes a pernicious habit of desire. Persons habituated to alcohol, therefore, all but invariably present an irregular state of the circulation, one moment a jaded, another an excited, circulation. In time this becomes the ordinary condition, supplemented by intermittent action of the heart and by a persistent functional derangement which extends through the whole vascular system.

A long-continued functional disorder from alcohol leads almost invariably to organic changes of the heart and circulation. The heart, from frequent over-action, becomes dilated, and its valves relaxed and flabby. The membranous structures which envelop and line the organ are changed in quality, are thickened, rendered cartilaginous and even calcareous or bony. Then the valves, which are made up of folds of membrane, lose their suppleness and valvular disease is established. The coats of the great blood-vessel leading from the heart, the aorta, share often in the same changes of structure, so that the vessel loses its elasticity and its power to feed the heart with blood by its recoil. In like manner the refined arteries which form the terminals of the arterial system undergo degeneration, and the recoil of the arterial system generally is reduced.

The muscular structure of the heart, owing to degenerative changes in its tissue, fails also under the influence of alcohol. The elements of the muscular fibre are replaced by fatty cells, or if not so replaced are transformed into a modified muscular texture by which the power of contraction is greatly reduced. It follows from these facts that the circulation, in all who indulge in alcohol, is subjected to many extreme dangers. Even the functional derangements are not without danger unless all parts and organs of the body are in the most perfect balance and health. During organic derangement the danger is at all times great; danger of sudden failure of the heart itself, of rupture of the blood-vessels, of effusion of blood into vital organs like the brain,

with production of apoplexy, or of effusion into other organs, such as the lungs or kidney, with interference of their function. Lastly, there is the danger, always present, of the heart and its subordinate parts failing in power from premature old age.

The blood is injuriously influenced by alcohol. The presence of alcohol in the blood interferes with the due oxidation. The blood corpuscles are easily made to undergo changes by which they become irregular in shape, truncated, or shrunken and notched or crenated at their edges. The plastic part of the blood is subjected to two modifications by alcohol. When the blood is feebly diluted with the poison the plastic part is rendered exceedingly fluid, so that the blood flows too easily from the vessels and injects the surfaces of the body, giving to the outer surfaces, like the skin, a mottled appearance, which in cold weather, when the vessels are greatly relaxed, extends even to a general blueness or leaden color. When the blood is strongly charged with alcohol, the plastic part of it, instead of being rendered thin, may undergo coagulation, and by such coagulation may impede the course of the blood in its circulation through the finer vessels or even through the heart itself.

Gout and Rheumatism, usually considered as diseases of the blood, but much more probably allied to nervous derangement in regard to their primary origin, are both influenced greatly, though not produced, exclusively, by alcohol. Gout often owes, without doubt, its origin to indulgence in rich and luscious alcoholic drinks, the drink known as port wine being the most potent offender. Such drinks favor rheumatism as well as gout. Their action is compound. They contain saccharine and fermentable principles which unite with the alcohol in favoring these specific affections.

Diseases of the Lungs from Alcohol.

From the paralyzing influence of alcohol on the vessels of the minute circulation, the lungs, as will easily be inferred, soon begin to share in the accidents and degenerations which follow upon the disturbance of blood produced by alcoholic indulgence. The pulmonary vessels are easily relaxed by alcohol, and as they of all parts of the body are most exposed to changes of heat and cold, they are easily liable to congestion when, paralyzed by alcohol,

they are subjected to a sudden fall of temperature. The sudden congestions of the lungs which so frequently occur in persons who indulge in alcohol during severe winter seasons are readily accounted for from this cause, and the long list of deaths which then characterizes our mortality tables tells, too forcibly, the story of alcoholic devastation.

I observed many years ago that there was a peculiar form of consumption connected with indulgence in alcohol to which I gave the name of *alcoholic phthisis, or the consumption of drunkards.* The disease occurs usually in persons over twenty-eight and under fifty-five years of age. These need not be charged with hereditary consumptive taint, though they may transmit the taint they have acquired. They are often considered as very healthy persons, who can endure anything, sit up late at night, and perform any amount of business. They may never have been drunk, but they are hard drinkers, and they bear drink with a tolerance that is surprising to lookers on. Of a sudden they break up with lung disease, they get pain in the side and pleurisy, followed by cough, vomiting of blood, rapid fibroid degeneration of the lung, loss of flesh, and speedy death.

Diseases of the Nervous System from Alcohol.

The nervous system shares largely in all derangements of the body produced by alcohol, and, in fact, it never escapes some injury. The nervous system suffers from various functional affections under alcoholic excitement and depression. It fails to receive correct impressions, it fails to send out correct commands, it fails to rest. Hence it is sometimes extra sensitive to vibrations set up within the body itself, and hears murmuring, ringing, or humming sounds, or sees shadows and spots and glintings which are not natural to it; or, blunted by excess, is oblivious of impressions to which it ought to be acutely alive.

One striking functional derangement of the nervous system under alcohol is that which is called *insomnia* or sleeplessness. The action of the alcohol is to keep the vessels of the brain relaxed, and no alcoholic sufferer is therefore a truly natural sleeper. He either lies restless with the brain undergoing an unnatural activity, sleeping but for a moment and then waking again, or taking an excessive dose of the poison he produces a congestion of the brain and a torpor which is not sleep, but rather a modified

apoplectic condition interrupted by startings and deep snorings, and ending in a collapsed insensibility.

In both men and women, but in women especially, alcohol leads to an hysterical condition, *alcoholic hysteria.* This disease is attended with great sensitiveness and irritability, noises and ringing sounds in the head, appearance of specks and spots before the eyes, flatulency with sense of fulness in the throat, emotional excitement from slight causes, and varied uncertain action of the mind, usually accompanied by reckless or feeble indecision of character.

Under the continued influence of alcohol the nervous centres undergo degeneration, and then diseases of the most serious kind are the subsequent and necessary phenomena. *Epilepsy* from alcohol is thus sometimes manifested, the disease assuming its most decided form and intensity, and proving, as a rule, fatal. *Apoplexy* is a second result from the same cause, and probably is a much more frequent result of alcoholic indulgence than is commonly supposed. The accident of rupture of a blood-vessel on the brain is doubly liable to happen in the diseased from alcohol; firstly, because of the weakened state of the vessels, and, secondly, because of the pressure to which the vessels are subjected during periods of excitement from the poison.

But the most determinate nervous injury resulting from the use of alcohol is *Paralysis.* When a person takes alcohol for the first time to complete drunkenness, he passes, through stages of moderate excitement, of extreme excitement, and of depression, into a state of temporary paralysis both of mind and body. His nervous system is overpowered by the alcohol. In like manner when men indulge for years in alcohol they pass through a series of long stages. At first the poison is to them a source of excitement; then of excitement with depression; next of depression altogether; and, finally, if they continue to indulge in it, of paralysis. Thus much of the general paralysis met with in our asylums is traceable to alcohol as the cause.

The action of the poison is upon the nervous matter and upon the membranes which cover the great centres of the brain and spinal cord. The membranes lose their power as dialyzing structures, and the nervous matter itself is made to undergo degenerative changes, from which follow the failures of voluntary, and in the end, of involuntary, power, leading to paralytic seizure and

paralysis. Alcoholic paralysis develops itself in two forms. In some instances it is local, affecting one limb or one side of the body, and not immediately interfering with the mental powers. In other instances it commences with a long stage of muscular feebleness, passes into mental alienation, and finally into a loss of all volitional power. The muscles retain some irritability, but the will fails to control them,—general paralysis.

Dipsomania. Mania a potu.

A distinct form of disease, produced by the poisonous action of alcohol, is that of craving for the poison until the craving becomes a form of mania. In persons affected in this manner, dipsomaniacs, there is a veritable disease marked by an insatiable desire for alcohol, by the ordinary physical symptoms which attend over-indulgence, by the development of the most depraved animal tastes, and by such extreme derangement of moral faculty that falsehood becomes one of the most striking of the phenomena by which the disease is characterized. Dipsomania assumes two forms. One, the intermittent, where the craving propensity comes on at intervals of time; the other, the continuous, in which the craving never actually ceases. Recovery from both forms is possible, during the early stages, under entire abstinence from the cause; but, as entire abstinence is not carried out, in the great run of cases, the common end is towards nervous degeneration and mental and physical death.

Delirium Tremens.

The disease known as delirium tremens is that most intimately connected in the public mind with alcohol as the producing agent. It is an acute delirium brought on by direct excess of alcohol. The delirium presents various phases. Sometimes it is violent, passionate, ecstatic; at other times low, muttering, and wandering. It is marked by dread apprehensions and imaginings of the presence of evil spirits, and especially of the devil, the conjured up visions offering to the sufferer all the characters of realities. With this mental excitement there are alternations of fever and coldness, of thirst and craving for drink, of maniacal raving, and of heavy prostrate coma. Through all there is one marked symptom, from which the disease takes part of its name, *tremor*, an uncontrolled action of the muscles, increased by any external irritation.

This tremor intensifies as the temperature of the body declines, as it does in many cases, even to an extent of from three to four degrees below the natural standard. The disease continues so long as the poison is supplied, and is so often fatal that it yields a calculable mortality registered from week to week in the returns of mortality. After recovery from delirium tremens the body is left enfeebled and the tissues prone to degenerative changes. My experiments have shown that the admixture of the heavier alcohols, like the amylic, fusel oil, with the ordinary alcoholic drinks, is a powerful adjunct in the production of delirium tremens.

Sterility and inherited feebleness from Alcohol.

Many observers have remarked that persons who indulge freely and for long periods in alcohol are subject to the nervous failure called sterility, and McNish observes that children born of parents who are enfeebled by alcohol are apt, from the general defect of vital power in the parental system, to be puny and emaciated, and more than ordinarily liable to inherit the diseases of those from whom they spring. I entirely endorse this view as consonant, in every particular, with my own experience.

Insanity from Alcohol.

It is admitted, with very few exceptions of opinion, that a certain percentage of insanity is produced by alcohol, but the exact amount is not satisfactorily ascertained owing to the complication arising from the study of the direct as well as the indirect effects of the poison. Professor Edgar Shepherd states that forty per cent. of the patients admitted into Colney Hatch Asylum were brought there from the direct or indirect effects of alcohol. The Commissioners in Lunacy attribute only fourteen per cent. from this cause. Other observers would make it still less than the Commissioners, and still others would make it greater than that which Dr. Shepherd has recorded. It is perhaps safest on the whole to accept the statement by the Commissioners in Lunacy as founded on the broadest basis of observation. The mental alienations connected with alcohol as their cause are, melancholia and various classes of acute mania.

Melancholia is a common mental disease of those who indulge freely, for as Dr. McNish says, though drunkards over their cups are the happiest of mankind, yet in their solitary hours they are

the most wretched. Gnawing care heightened by remorse preys upon their conscience. The weapon they employ to drive away care is turned upon themselves; and every time it is used, it becomes less capable of scaring the fiend of melancholy, and more effectual in wounding him that uses it.

Homicidal mania induced by alcohol is, unfortunately, of too common occurrence to need description. *Suicidal mania* from the same agency is still more common. In my own experience I have seen six examples of suicide brought on by the poisonous action of alcohol.

Diseases of Glandular Organs from Alcohol.

Two of the glands of the body, the liver and kidneys, are peculiarly liable to disease from alcohol. They are the two glandular organs most concerned in the process of elimination of the poison, and are always, until they are structurally damaged, actively engaged in removing it from the body. For this reason they, like the heart, are extremely liable to undergo structural disease.

The organic disease of the liver called cirrhosis, which has already been described in the previous book, page 208, is so specifically an alcoholic malady that it has been called "gin-drinker's liver." It affords one of the most striking illustrations in the whole range of pathology of a structural disease induced by a known external cause.

The various diseased conditions of the kidney known under the title of Bright's disease, also described in the preceding book, pages 214–16, are commonly due to the action of the alcoholic poison. They may, truly, be induced by other causes than alcohol, as by scarlet fever, small-pox, and possibly typhoid; but experience has shown that the large majority of cases of the kind is from alcohol.

Calculus, or stone of the bladder, described at page 217, is intimately related to excessive use of alcoholic drinks. Indulgence in malt liquors is a common cause of this affection.

Summary of Diseases from Alcohol.

There are, it will be seen from these last pages, no less than twenty diseases acquired by humankind from this one poisonous agent alone, and I might have added, if I had entered on specu-

lative ground, certain other affections, such as cataract and amaurosis, as due, in some cases, to the same destructive agent. I might also have dwelt on premature decay and old age from alcohol, the course of which will easily be inferred by the intelligent reader.

A substance which leads to so much disease leads also of necessity to a great mortality, from a variety of causes, physical and mental. I do not think it is an exaggeration to say, as an illustration of this fact of injury and mortality, that in the United Kingdom over a hundred deaths by violence occur per week from alcoholic excitement, and a thousand deaths per week from the diseases which directly and indirectly follow from indulgence in the use of alcohol.

Disease from Cannabis Indica, Haschish, or Bang.

The active principle of Indian hemp, called haschish or bang, induces very definite and peculiar phenomena of disease in those who indulge in it. It is a substance extensively used in Eastern countries as a luxury, and occasionally it is resorted to in Europe and even in England. It is an extract prepared from the Indian hemp, and is taken usually in the solid form, but sometimes as a tincture.

Like other narcotics, haschish creates an intense craving for itself. The symptoms which follow upon indulgence in it are drowsiness and intoxicant dreaming, with visions of the most ecstatic character, during which time and space seem to be expanded into infinite proportions, and all the events of a lifetime concentrated into a passing moment.

Persons who become confirmed in the habitual indulgence of haschish seem at last to suffer organically, the mind becoming excitable, with mental aberration followed by feebleness of intellect as the sequence. During the acute period of action, as I observed in a person who insisted on indulging in the narcotic, there is a slight febrile condition, flushing of the face, dilated pupils, rapid speech, considerable mental excitement followed by hysterical somnolency, sobbing and plaintive utterances, but without any evidence of physical pain.

Diseases from Chloral.

The saline substance known as chloral hydrate was introduced as a narcotic in 1869 by Dr. Liebreich, of Berlin. The first introduction of it into this country was by a Report of mine made at the British Association for the Advancement of Science at the Exeter Meeting in 1869. In that Report I pointed out that as the hydrate acts by causing a decomposition of the blood, as it undergoes decomposition itself, and seizing the natural alkali of the blood adds to the blood a new salt, sodium formate, it remained to be seen whether untoward results would not follow upon its frequent use. This suggestion was soon shown to be true, and in a very few months a disease, to which I gave the name of *chloralism*, was added to the catalogue of diseases. In 1871, in a Report made to the British Association at Edinburgh, I showed that as there were dipsomaniacs and opium-eaters, so there were then large classes of persons who had become habitual consumers of chloral. Since that day chloralism has largely increased as a form of disease. The symptoms are well marked. The craving for the narcotic is extreme, and sleep is rarely obtained without its aid. The digestion suffers, the appetite becomes bad, and the secretions unhealthy. After a time the circulation follows in derangement, the pulse is at one time very full and bounding, at another time feeble and irresolute. The action of the heart is irregular, irritable, and intermittent. Following upon these indications the nervous functions become deranged, the mind becomes enfeebled, the temper capricious, the resolution irregular. The limbs are rendered unsteady, the face is easily flushed, and the eyes are reddened under slight excitement.

Under longer-continued use or abuse of chloral the blood begins to suffer. Owing to the action of the new salt with which it is charged the blood is rendered unduly fluid, and phenomena like those of scurvy are produced. I have twice seen bleeding from the gums brought about in this manner by chloral, and I have several times seen dark blotches on the skin,—purpuric blotches. I, as well as other observers, have also seen an eruption on the skin which, assuming in the first place the character of ptyriasis, has passed into eczema. To this stage of the disease I have given the name of *chloral purpura* or *scurvy*.

In a few other instances I have seen jaundice as the result of chronic indulgence in chloral hydrate as a narcotic.

Disease from Chloroform.

I have seen a few examples of disease brought about by the habitual use of chloroform, and have known one death from this cause. The phenomena are usually induced in those who have commenced to take chloroform for the relief of pain or spasm. The craving for the agent is soon a very marked symptom, and the bad results of its action steadily appear. The digestive organs suffer, the appetite becomes imperfect, and the secretions irregular. The circulation follows in disorder, the heart becoming irritable, palpitating, feeble, and intermittent. The nervous system is speedily deranged, the memory is rendered treacherous, the mind depressed, and the sleep all but impossible without the narcotic. Jaundice is another symptom occasionally incident to this form of induced disease.

Chloroform administered by the surgeon sometimes destroys life. I have estimated the fatality produced by it in this way as at the rate of one death to 2500 administrations.

Disease from Ether.

The light fluid substance called ether, or more correctly ethylic ether, and which is used by the surgeon, by inhalation, for the production of general anæsthesia, and in the form of spray for local anæsthesia, is sometimes a cause of induced disease. I have known symptoms of disease to follow the habitual inhalation of ether, and though they are transient in character they are serious so long as they are present. They consist of fulness of the head, stupor, unsteadiness of gait, and a sense of falling forward. During recovery there is a tendency to hysterical laughing and sobbing, with extreme sensitiveness to sounds, symptoms which remain for some hours after the inhalation has ceased, and which are attended with dyspepsia.

In and about Draper's Town in the north of Ireland a practice has been in existence for nearly forty years of drinking ether instead of alcohol. The craving for the agent is very great, and those who are habituated to it often take several ounces of ether

per day. Direct intoxication is the common and speedy result of this procedure, but the insensibility does not last long, and is followed by far less distressing symptoms than those which succeed upon intoxication from alcohol. The evidence of organic disease from ether drinking is not very decisively marked, but the dyspeptic and other symptoms noted above, as following inhalation, are generally present if the indulgence be carried to a great extent. Occasionally death succeeds upon taking a large dose of ether. Dr. Morewood of Draper's Town has witnessed four such fatal results, and has seen many cases in which the symptoms produced were all but fatal in degree.

Disease from Nitrous Oxide.

The gas known under the name of nitrous oxide, and which is used as an anæsthetic, chiefly for the extraction of teeth, is sometimes a cause of induced disease. Sir Humphrey Davy, who first introduced nitrous oxide as an anæsthetic, so habituated himself to the inhalation of the gas that he could not, he tells us, look at a gasholder or watch a person breathing without feeling the desire to inhale. The symptoms the gas induces are those of sleep, accompanied with dreams more or less ecstatic in character. Considering how largely this gas is used it is remarkable what a small number of injurious effects are caused by it. Sir Humphrey Davy does not seem to have been physically injured by it although he inhaled it so many times, and, as we see, modern experience of its use runs in confirmation of the same fact.

I have twice, however, seen results from it that assumed an alarming character. In one instance continued headache, vertigo, and nausea followed its administration, with very slow recovery. In another instance the phenomena induced were far more severe. The headache and vertigo lapsed into a seizure resembling epilepsy in character, recovery from which was followed by hysterical unconsciousness, febrile excitement, extreme dyspepsia, and recurrent convulsive movements. The affection thus excited lasted, in its acute form, for several weeks, and ended in a slow recovery.

In very rare examples nitrous oxide has proved immediately fatal during inhalation; but it must be admitted that this extreme accident has occurred less frequently from it than from any other anæsthetic.

Disease from Opium.

Opium produces symptoms of induced disease under two modes of its use. It is sometimes inhaled as opium smoke. It is sometimes taken in the solid form, or in the form of tincture.

Opium smoking is a habit very extensively practised in Eastern countries, and is believed to be on the increase, as a practice, in this country. Opinion seems to be somewhat divided in regard to its harmfulness, but from what I have myself directly observed I can have no doubt that it is productive of most serious mischief, functional and organic. The habit, when once it is commenced, is most persistent, and brings its devotee, in the end, to a pitiable condition of mental and bodily inactivity. The symptoms induced are those of stupor, sleep, and restless dreaming. After a time the digestion is deranged, the circulation is irregular, the nervous system torpid, the nutrition indifferent, and the secretions inactive. In extreme cases there is, in the end, premature and general reduction of vital power.

Opium eating or drinking leads to a series of phenomena of disease which are fairly uniform and long persistent. The acute phenomena are those of strange and wandering dreams, occurring during prolonged sleep, and followed, after waking, by dulness, pain and weight in the head, and mental depression. In the confirmed opium-eater this mental depression continues, in an increasing ratio, until resort is once more had to the cause of it. In fact a new life seems to be ingrafted on a new food the desire for which lapses into what may be called an insatiable instinctive faculty. Under the action of opium the digestive organs soon fail in their functions, the appetite is impaired, the secretion of bile is diminished, the bowels are constipated, and there is a persistent sense of feebleness and of emptiness in the abdominal region. In consequence of the bad digestion and assimilation the body wastes, the skin shrinks, the circulation becomes feeble, the eye dull, the pulse quick and irritable, and the tongue dry, red, and sometimes furrowed. In the end the centres of the nervous system lose their activities, and paralysis of some portion of the body is the result. The lower limbs fail first, then the muscles of the back, so that the body, lame and bent like the body of an old man, falls into the decrepitude of senile degeneration. Death from wasting, owing to failure of digestive power, closes the scene.

A modern form of induced disease from opium is by using it in solution as morphia for injection under the skin,—subcutaneous injection of morphia. The narcotic solution is taken up in a small syringe and injected through a fine needle into the cellular tissue. The practice commonly commences for the relief of pain, particularly the pain of neuralgia, a minimum medicinal dose of the drug being originally used. The dose is gradually increased when the practice is persisted in, and in some examples a great number of grains of morphia are injected during the day. I have seen the skin so punctured from this operation that it was somewhat difficult for the sufferer to find a new place in which to insert the needle. At first nausea and even vomiting occur soon after the injection, and when these symptoms subside they are succeeded by defective digestion, irritability or slowness of the circulation, reduced secretion, torpor of the nervous system, insatiate craving for the drug, muscular prostration attended with hysterical excitement, and general inertia, inanition and failure of power. In the end there is usually a gradual paralysis commencing in the lower limbs and extending throughout the muscular system, together with wasting degeneration of muscular tissue and death.

Disease from Tobacco.

The dust arising from tobacco leaf, during the process of making cigars, is most injurious. While the leaf is being rolled up, unless the ventilation of the work-room is exceedingly perfect, the dust from broken leaves and siftings is inhaled, and proves most irritating. In the course of drying, the dust and vapor from the drying-room act in combination, and lead not only to oppression of breathing but to irritation of the throat, and, in the young, to giddiness and nausea. One workman told me that he never got over a bronchial irritation produced by this dust until he left his work at night, then the effect subsided.

The dust produced in the various processes of snuff-making is still more injurious. The tobacco leaf, finely cut up, is mixed with lime-water, salt, sometimes even floor-dust sweepings, and, in yellow snuff, with red lead. These ingredients, placed in a bin and heated twice or three times, to give sharpness to the snuff, are frequently turned over in order to facilitate the process of drying. While this turning is in progress, there arises a dust

with a smoke, which so affects the younger workmen that they become faint and vomit, until, by use, they are rendered tolerant of the poisonous matters they inhale.

In the further process of finishing the snuff, after it has been ground and dried, there is what is called sifting "the shorts," preparatory to adding the "liquors," viz., salt and water to make weight, and scents to give perfume. The sifting charges the air with dust, which is as injurious as the smoke, and which produces severe symptoms in the young, retching, faintness, and great irritation of the bronchial passages. The rooms in which these works are carried on are too often close and unventilated, and thereby the irritation of the throat, the cough, and the nausea are much increased. Sifting the "shorts" is more hurtful than rolling the cigar. The consolation of the workman is that he becomes accustomed to the poison if he only keeps to the work, and at last gets over the symptoms.

In so far as the acuteness of the symptoms is concerned the workman is generally correct, but it is not to be presumed that the mischief stops at this point. The system of the workman becomes tolerant in some measure, but the tolerance is only partial. Chronic maladies, which are of serious and even fatal import, are induced by continued application. Those workmen who are disposed to pulmonary consumption suffer readily from that disease, while in others, of better constitution, less serious, but still serious derangements are manifested, the most common of which are a persistent dyspepsia and that pale and bloodless condition to which the technical term anæmia is applied.

Another common symptom is a rapid and irregular action of the heart. Palpitation of the heart, and intermittent action in which the organ hesitates in its beat, are marked phenomena. I think I may, indeed, say that in these workmen the action of the heart is never at its full power, and never perfectly regular so long as they are following their employment. In cases where the chronic effects are most intense, the muscles of the body share in the feebleness and disturbance. The hands become tremulous, the lower limbs unsteady. In two examples I have seen the breathing muscles influenced and an extremely painful spasm produced through the chest, followed by faintness, as if the sufferer were about to die.

Lastly, the organs of the senses are impaired from these occu-

pations. There is deafness and an imperfection of vision, which renders light painful to the eye. It is also unfortunate that these occupations lead often to the habit of smoking or chewing tobacco, and when either habit occurs the evil consequences are greatly increased. I believe few workmen escape altogether the dangers I have named, and not many are able to carry on their business beyond their fortieth year.

Tobacco Smoking.

Ever since the habit of smoking tobacco has been introduced into civilized communities its bad influence upon the health has been acknowledged by all who have cared to look the subject plainly in the face. Even the advocates of smoking are often constrained to admit that the habit causes what they call temporary or functional symptoms which, to say the least, are unpleasant. It certainly produces functional derangements in most cases; in many cases it does a great deal more.

Tobacco smoke is a compound substance. It contains water in a state of vapor; free carbon diffused in fine particles, soot; ammonias in a state of vapor; carbonic oxide; carbonic acid; an organic product coming over in vapor and condensible into an oily substance called nicotine; an empyreumatic ammoniacal substance; and a resinous bitter substance. Of these substances the most dangerous are the carbonic oxide and the nicotine. These are present, no doubt, in extremely small proportions, but even in these small proportions they are active poisons. The carbonic oxide tends to produce drowsiness, irregular action of heart, convulsive snatches of the muscles, and nausea or vomiting. Nicotine tends to produce tremor, palpitation of the heart, and paralysis. Some of the other agents named above are not altogether innocuous. The ammonias bite the tongue after long smoking, making the tongue and throat dry; they cause free secretion of saliva, and they produce a solvent action on the blood and the red blood corpuscles. The volatile empyreumatic substance causes a sense of oppression, and gives an unpleasant odor to the breath. The bitter extract is nauseous to young smokers, and produces disturbance of the stomach.

Derangement of the Digestive System.

Most of the great systems of the body suffer from the effects of tobacco smoke, but of all systems the digestive is the one most affected. The tongue of the confirmed smoker is rarely clean, the appetite rarely perfect. The mucous membrane of the mouth, tongue, and throat is often much irritated, the salivary glands are excited to profuse secretion, and the tonsils are often rendered large and irritable. The mucous membrane of the stomach is irritated and secretes its digestive fluids irregularly, with frequent excretion of acrid fluid which causes heartburn, eructation, and general debility. The muscular fibres of the stomach are also influenced, losing their tone and activity. The food, therefore, in a confirmed smoker seldom passes through complete digestion, and constipation and irregular action of the bowels are the consequences. On the whole dyspepsia may be said to be the malady of the confirmed smoker, and the terms "smoker's sore throat," "smoker's tongue," "smoker's salivation," are too familiar. When the smoker is not cleanly in his habits a deposit of an earthy kind takes place, on the teeth, from the saliva,—*salivary calculus.*

Cancer of the lips or tongue has not unfrequently been connected with smoking, and the cancer of the lip at the point where the pipe presses has often been observed as the spot from which epithelial cancer takes its rise. I have no doubt that the irritation produced by the stem of the pipe does excite epithelial cancer in persons predisposed to that affection, but I do not think there is sufficient evidence to show that tobacco smoke itself is an exciting cause of cancer.

Derangement of the Circulatory System.

Tobacco smoke does not, I believe, produce organic disease of the heart or other parts of the circulatory system, but it renders the blood unnaturally fluid, it injures the red blood corpuscles, and it greatly disturbs the action of the heart and of the arteries. It creates palpitation of the heart, irregular motion, intermittency, and, in extreme instances, cardiac breathlessness, attended by acute pain or spasm through the chest. It causes constriction of the blood-vessels of the minute circulation, paleness of the face, and anæmia.

Derangement of the Respiratory System.

The action of the smoke of tobacco on the mucous lining of the bronchial pássages is to produce much irritation, attended often with cough and expectoration. At the same time, considering how large a surface in the lungs is immediately exposed to the vapor, it is remarkable that the irritation should be so limited as it really is. I have often been obliged to prohibit smokers who suffer from bronchial irritation the indulgence of the pipe, but I could not say that I have ever known organic disease of the lungs to spring from smoking. I have entered largely in another place into the question whether pulmonary consumption and bronchitis are directly caused by the action of tobacco, and I think I have conclusively shown that they are not. At the same time I am convinced that when either of these diseases is present smoking adds to the mischief. This is particularly true in regard to consumption, for smoking interferes with the due oxidation of blood and promotes indigestion, both of which derangements are favorable to the development of the inherited affection.

Derangements of the Nervous System.

The opponents of tobacco unite in the expression of opinion that tobacco smoke seriously affects the nervous function, and even produces nervous diseases, such as apoplexy and paralysis. In one remarkable and exceptional instance I witnessed in a man fatal symptoms which had been induced purely from excessive smoking. In this instance death came on from a paralysis, involving, I may say, the whole nervous system, for all the motor powers, voluntary and involuntary, together with the mental powers, collapsed. As a rule, however, tobacco smoke does not produce structural or organic nervous change, although it keeps the nervous system in a continual state of irritability and debility. It also creates giddiness and unsteadiness in some persons,—vertigo; and, without any doubt, it dulls while it seems to soothe the mental faculties. It causes also irritability of temper and a craving for itself which amounts too often to a kind of mental disorder. Through the sympathetic nervous system tobacco acts on the glandular system, exciting over-secretion followed by an impaired secreting power. I do not accredit the hypothesis that tobacco smoking is a cause of insanity.

Derangements of the Sensory Systems.

There can be no doubt that smoking produces serious functional derangement of the senses. It markedly impairs the senses of taste and smell, and probably renders less accurate the sense of touch. But the senses most seriously influenced by it are those of hearing and sight.

The specific effect of smoking on the sense of hearing is indicated by a confusion of sounds, with a difficulty in appreciating sounds that are very soft or unusually loud. This causes the affected person to ask questions with respect to articulate sounds which by others are distinctly heard. When this symptom is presented it is usually followed by that of a sudden sharp ringing in the ears, which may be excited, at one time, by a slight external noise, and, at other times, without any noise at all. These symptoms are often long continued in smokers, but happily pass away, as a general rule, when the habit is discontinued.

On the sense of sight tobacco smoking produces, indisputably, phenomena of a serious character. In moderate smokers the sight is often perplexed. Letters become confused in reading, luminous specks float before the eyes, deep-seated pain is felt in the eyes, and the vision is, at times, attended with irritability, as if the sight could not be firmly fixed on an object. In inveterate smokers the pupils are unnaturally dilated, and when the light is very strong the vision is imperfect.

The best evidence that the tobacco is acting injuriously on the sense of sight is supplied when there is a long retention of images on the sensorium after the eye is withdrawn from them. This when long continued indicates that the retina or nervous screen is becoming affected, and the symptoms which follow are generally indicative of steady impairment of vision under all conditions. In time there is produced a disease which is called "tobacco amaurosis," one of the most determinate forms of blindness when completely established. In this instance the habit of tobacco smoking produces a distinct organic or structural disease.

Effects of Smoking on the Young.

From what is written above it will be seen that tobacco plays an important part in the *rôle* of induced diseases. I have spoken so far of its effects on adults only. In the young those effects are

infinitely more serious. In them smoking checks nutrition, bodily development, and mental development, to such an extent that if a community of youths of both sexes were trained to early smoking, and if marriage were confined to them, an inferior race of men and women, compared with what is now existing, would, of necessity, be born. To the credit of our women this experiment is not being carried out.

Effects of Tobacco taken as Snuff.

Indulgence in tobacco in the form of snuff has now considerably decreased, but the habit, when it is carried out, is, decisively, productive of injurious effects. Many of the results attributable to smoking are produced by snuff, especially those which are exerted on the throat and on the digestive and nervous systems. Profuse snuff-takers are, as a rule, always dyspeptic, for the particles of the snuff pass down into the back of the throat and are swallowed, so that the direct action of the poison on the stomach is brought about. I have seen confirmed indigestion, injected throat, irritative cough, and vertigo, with other nervous phenomena, induced by the inhalation of tobacco as snuff, and I have once known further poisonous results from the action of lead with which the snuff was adulterated.

Disease from Tea.

The common beverage tea is often a cause of serious derangement of health, if not of actual disease. The symptoms of disturbance occur when even the best kind of tea is taken in excess, and almost inevitably from the mixture called "green" tea when that is taken even in moderate quantity.

It is common to speak of tea as a stimulant, and it is quite correct so to speak of it when the term is properly understood. Tea first quickens and then reduces the circulation, which is the action of a stimulant. But tea does more than this; it contains tannin, and is therefore styptic or astringent in its action, from which circumstance it is apt, in many persons, to produce constipation and interference with the function of the liver. In some persons this astringent effect of tea is very bad. It gives rise to a continued indigestion, and to what is called biliousness.

The most important agent, however, in tea is the organic

alkaloid *theine*. This alkaloid exercises a special influence on the nervous system which when carried to a considerable extent is, temporarily at least, if not permanently, injurious. At first the alkaloid seems to excite the nervous system, to produce a pleasant sensation, and to keep the mind agreeably enlivened and active. The effect is followed by depression, sinking sensation at the stomach, flatulency, unsteadiness with feebleness of muscular power, and, not unfrequently, a lowness of spirits amounting almost to hypochondriacal despondency.

In those who live in the midst of poverty, and who, having insufficient food, meet the craving for natural food by taking large quantities of tea, a strong craving for it is engendered which leads to the taking of tea at almost every meal, greatly to the injury of the health. Poor women in the factory and cotton districts become actual sufferers from this cause. They are rendered anæmic, nervous, hysterical, and physically feeble. In better classes of society similar if not such severe injury is effected by tea in those who indulge in it many times a day, and especially in those who indulge in what is called afternoon tea, a repast, if it may be so styled, partaken of late in the day, and, probably, when the stomach is nearly empty of food. The afternoon tea, or drum, causes dyspepsia, flatulency, nervous depression, and low spirits, for relieving which not a few persons have recourse to alcoholic stimulation, a procedure simply calculated to give temporary relief and to increase and confirm the mischiefs that have been inflicted.

Tea taken late in the evening, except immediately after a moderate meal, interferes with the sleep of most persons by causing indigestion, with flatulency, and sense of oppression. Some are kept awake entirely by the action of the tea on the nervous system; others get off to sleep, but are troubled with dreams, restlessness, and muscular startings. In a few, incubus or nightmare is a painful symptom induced by tea.

As persons advance in life the bad effects of tea sometimes pass away or are greatly modified, so that it can be tolerated by them as well as enjoyed; but in the young during the earliest periods of youth it is, I might really say, unexceptionally injurious. It leads to nervous exhaustion and to mental nervousness, so that the simplest natural phenomenon, a dark cloud, a deep shadow, or a sudden sound, excites anxiety and fear.

The most characteristic effects of tea are instanced in "tea-tasters," persons who by profession are engaged to determine the qualities of teas by the process of tasting different specimens of strong teas. I have several times been consulted by gentlemen who have been thus occupied on account of the symptoms from which they were suffering. They complain of deficiency of secretion of the saliva, of distaste for food, of deficient appetite, of nausea, of nervous depression with muscular tremors and feebleness, of constipation, flatulency, and almost entire inability to sleep. On giving up the practice of tasting, the symptoms, as a rule, disappear in a few days.

I am not aware that actual organic disease ever takes place from the use of tea, and it would therefore be more correct to speak of the phenomena it induces as phenomena of functional derangement rather than of actual disease.

Disease from Coffee.

Coffee in no way rivals tea as a cause of derangement or disease, but, like tea, it contains an alkaloid which in action somewhat resembles theine. The alkaloid is called *caffeine*, and the effects it produces are upon the nervous system, on which it is said to be a stimulant. Coffee is less astringent than tea, and indeed on most persons it exerts no astringent effect at all, but that rather of a relaxant after the immediate nervous stimulation has passed away. For this reason coffee induces, in some individuals, diuretic phenomena, and in others relaxation of the bowels. In some both conditions. Indulged in too freely it usually produces dyspepsia and flatulency, and taken late at night is, like tea, too often provocative of sleeplessness, ending in disturbed dreams, muscular startings, and nightmare. Coffee is usually pronouncedly injurious to the young; in persons of advanced life a tolerance to its action is often established.

I must repeat in relation to coffee what I have said about tea, namely, that there is no evidence as to its ever being a cause of actual organic change. Its effects may be described as entirely functional, and as being more correctly defined under the head of derangement than of disease. The derangement is much increased by the addition of chicory.

DISEASE FROM COCCULUS INDICUS, LEVANT NUT.

The fruit known under the name of Cocculus Indicus, or Levant nut, is used as a poison for killing fish and birds. The kernel is the part employed for this purpose, and the active principle is a crystalline substance called *picrotoxine.*

The phenomena produced by cocculus indicus are those of vertigo, delirium, and insensibility, with deep stertorous breathing, convulsive motion, and spasm. On first taking the poison it causes vomiting and purgation, with considerable pains and cramps. Also during recovery from the narcotic effects there is purging, cramp, and coldness, followed by reactive fever. I quote these phenomena from the one exceptional instance in which I could feel sure that cocculus indicus was the cause of the symptoms; for although I have been called to two other cases in which it was supposed to be the cause of acute disease, I am of opinion that in them an impure alcohol, an alcohol containing fusel oil, was the poisonous agent.

Owing to the large quantity of cocculus indicus that is imported into this country, and the difficulty of accounting for its use, it has been assumed to have been employed for the adulteration of beers, and especially for those beers which go to India. I do not think there is any satisfactory evidence in support of this hypothesis. I was instructed at one time to make a special inquiry for the detection of cocculus indicus in beers sold in London, and in some that were reputed to be prepared for Indian exportation; but I found no trace of the substance, although I searched for it in a very large number of specimens. Amongst my medical brethren I have never met with one who could give me any satisfactory proof that he knew the symptoms except by what he had read of them in the few recorded examples supplied in works on Medical Jurisprudence.

DISEASE FROM ANILINE.

Since the manufacture of aniline dyes has become a great commercial pursuit, serious injuries have occurred to the workmen employed in the manufacture of them. The first decisive case of injury from this substance which attracted marked attention occurred in a lad sixteen years of age, who was brought into the

London Hospital, from some aniline works in which he was engaged, on the 9th of June, 1861. The lad had been found in a state of insensibility in the interior of a vat used for the manufacture of aniline. He was pale and cold; but that which attracted most attention was the extreme blueness of his lips. The lad recovered, but on the following day he still remained blue, and his breath smelt strongly of aniline.

Three years later, Dr. Kreuser, of Stuttgart, reported a set of new facts respecting the influence of aniline on the industrials employed in its manufacture. He showed that the vapor, when it does not act to the extent of producing insensibility, causes violent dry spasmodic cough. He also noticed for the first time that the vapor produced ulceration of the skin in the lower extremities, with much pain and swelling. The ulcers rapidly healed when the workmen were removed from the influence of the vapor.

Later, Messrs. Knaggs and Mackenzie in this country, and M. Chevalier in France, discovered that a peculiar and extreme neuralgia is induced by the vapor of aniline. The neuralgic attacks begin with an intense nervous pain in the head, and a giddiness increasing almost to faintness.

Two French investigators, Tardieu and Roussin, have made some important researches on the physiological action of the red and yellow dyes, by which they have determined that when living animals are subjected to these substances, a fatty change takes place in the minute structure of the vascular organs. The liver, specially, is made to undergo fatty degeneration and the tissues are dyed with the color. From the dye-stuff extracted from the animal organs the experimentalists dyed a skein of silk.

We have no evidence, as yet, that the phenomena of fatty change have ever occurred in the human subject, although it is fairly to be inferred that a long exposure to the vapor would lead to this result.

Aniline Erythema.

The introduction of wearing apparel, socks, stockings, and flannels, made, by new processes of dyeing, to assume a rich red or yellow color, has led to a local disease of the skin, aniline erythema, attended in rare cases with constitutional symptoms. The disease is, primarily, due to the dye-stuffs. The chief poisonous dyes are the red and yellow coralline, substances derived from

that series of chemical bodies which have been obtained of late years from coal tar, and commonly known as the aniline series.

The coloring principle is extremely active as a local poison. It induces on the skin a reddish, slightly raised eruption of minute round pimples which stud the reddened surface, and which, if the irritation be severe and long-continued, pass into vesicles discharging a thin watery ichor, and producing a superficial sore. The disease is readily curable if the cause of it be removed, and, as a general rule, it is purely local in character. I have, however, once seen it pass beyond the local stage. A young gentleman consulted me for what he considered was a rapidly developed attack of erysipelas on the chest and back. He was covered with an intensely red rash, and was affected with symptoms of nausea, faintness, and depression of pulse, of a singular and severe kind. I traced both the local eruption and the general malady to the agency of aniline dye contained in one of those red woollen chest and back "comforters" which are commonly worn in cold weather. On removing the "comforter" the symptoms ceased and recovery was speedily effected.

Sir Erasmus Wilson gives the name of *dermatitis anilina* to a local affection produced by aniline dyes, which may be accepted as a severer form of that which I have called aniline erythema. Respecting the effects of these dyes upon the skin, Wilson says that they have been observed both in the hands and the feet from the use of gloves and stockings colored with the pigments. The feet are most frequently the victims, the dyes, in some instances, being transferred to the skin, while in others the patterns of the stocking are represented on the skin by tracings and figures of inflammatory redness. The inflammation caused by the pigments may be set up in the course of a few hours and may present the characters of an aggravated eczema, attended with considerable effusion beneath the scarf skin, raising it up into blebs which sometimes occupy the whole of the surface of the sole of the foot. Occasionally, according to this authority, the inflammatory rash is transferred to the hands, even when those members have not been in contact with the poison, and a general irritation of the entire skin is set up by propagated irritation.

Happily the insolubility of the dye-stuff in water and in the watery secretion of the skin prevents its ready absorption into the body; for if it were easily absorbed it would so often prove fatal

amongst the workers engaged in manufacturing it and amongst those who wear clothing colored with it, that it would be a source of public danger. We have seen a little above that, according to the experiments of Tardieu and Roussin, fatty degeneration of the liver was easily induced in the lower animals by the dye, and that the other tissues were colored by it. They further observed that the coloration specially affected the lungs, and it may therefore be fairly assumed that two, at least, of the vital organs must suffer if the aniline obtained admission into the blood and circulated with the blood through the body.

Up to this time I have not personally witnessed any serious changes of the kind, but while this part of my work was in progress I observed that an inquest was held on a person who was assumed to have died from absorption of aniline dye by a wound in the skin.

Disease from Nitro-Benzole.

The oily liquid called nitro-benzole is a source of danger to persons employed in chemical works, and has, more than once, proved a fatal danger. Long exposure to the vapor of this substance produces nervousness and torpor, and when the vapor is inhaled in a concentrate form, the drowsiness, after from three to four hours, passes into stupor and intoxication, and soon after into coma or apoplectic sleep. The mind remains tolerably clear until the stupor suddenly comes on, and then the insensibility is complete. The body falls precisely as in apoplexy, and death ensues in about five hours.

Dr. Letheby, who of all observers has most carefully inquired into the action of nitro-benzole, is of opinion that the poison is reduced in the body into aniline by giving up its oxygen, but that on the surface of the body the opposite condition is in progress, by which the salts of aniline are oxydized, and are converted into mauve or magenta purple. I have learned of another mischief incident to the manufacture of nitro-benzole. In making it, by acting on benzine with nitric acid, vapor of hypo-nitric acid is freely evolved. This vapor produces great bronchial irritation, nausea or vomiting, and colic. Chevalier has reported on these facts, and has added some others which in England have not been noticed so distinctly. He says that the process of washing the nitro-benzine is more painful than the making of it, and that the

vapor of benzine itself induces intense headache, a fact I can fully confirm.

Disease from Paraffine.

We are indebted to Dr. Alexander Ogston for the first observations that have been made on disease from paraffine. The workmen engaged in the manufacture of crude paraffine have the skin of their hands, of their feet and legs, and of other portions of their bodies, brought daily, for many hours at a time, into contact with the paraffine shale and with the oily matters mixed up with it.

Two distinct classes of symptoms characterize this disease, one acute, the other chronic. In the acute form the parts of the skin exposed to the crude paraffine are covered with a rash of bright red nodules which lie close together, and are largest and most numerous on the wrists and where the dress fits tightly. The palms of the hands and soles of the feet are not affected, but the back of the hands and upper surface of the feet suffer severely.

Similar nodules arise, though to a lesser extent, on the face, neck, and other parts of the body to which the oily matters find access. In the acute form of the disease the size of each bright red nodule is about equal to a grain of barley; it is hard to the touch, tender on pressure, and rounded in shape. Dr. Ogston discovers that each nodule consists of a single hair follicle with the parts immediately surrounding it; the whole in a state of active inflammation. The hair emerges from the very summit of the nodule, and the orifice of the hair follicle, much enlarged, is easily visible to the naked eye as an aperture of a magnitude similar to that of a pin-hole in a card. The dilatation extends to the deeper part of the follicle, which forms the kernel of the inflamed knot. The redness and hardness of the nodule after a time disappear, leaving the hair follicle enlarged and its mouth gaping so as to show retained masses of epithelial scales.

"In all paraffine workers," Dr. Ogston remarks, "openness and enlargement of the hair follicles continue to some extent, and the black dots on the skin of their hands and face strike the eye of the observer at once. Men with dark complexions and strong hair are specially deformed in this way, while those of fair complexions

and of light or reddish hair escape comparatively unaffected. The chronic form of the disease exhibits the following characteristics. The backs of the feet and toes, the backs of the hands and the backs of the fingers, between but not over the joints, present a honey-combed appearance of the skin. The skin is elevated, thickened, and inelastic, so as to prevent and render difficult and painful the flexion of the fingers and hand. The raised honey-combed patches are of natural color, and are not inflamed, but consist of deeply-grouped arrays of hair follicles with a hard deep skin between and around them ; the follicles packed with dry, brittle accumulations of epithelial scales, so extensive as to be easily visible through the follicle, the latter being large enough to admit the extremity of an ordinary probe. The hairs themselves have disappeared from these patches, having probably become atrophic from the pressure of the epidermic masses, while cracks and bleeding fissures traverse the indurated parts, and in rare instances a follicular abscess gives variety to the picture."

When the malady becomes confirmed the general health of the sufferer is greatly affected ; the complexion becomes pale, the skin becomes loaded, the body wastes, and the constant irritation and pain of the skin produce sleepless nights. Dr. Ogston accounts for the production of the disease in a very clear and satisfactory way.

"The oily matters in the shale called blae oil, when separated, are both penetrating and irritating to the skin ; coming continually in contact with the epidermis, they soak into the hair follicles, where they create an irritation soon leading to hardening and increased shedding of epithelial scales. This shedding of the scales is not counterbalanced by increased expulsion, owing doubtless to the large quantities cast off, and to the natural fatty and lubricating substances being dissolved out and removed by the blae oil. Thus the brittle epidermic masses or scales plug the follicles and increase the irritation. Parts of the kind supplied with sweat glands and no hair follicles,—palms of the hands, soles of the feet, and knuckles of the fingers and toes,—escape the irritation. After a time the hairs and the most exposed parts waste and fall out, but the retention of the epithelial masses keeps up the process in the follicles and the hardening of the surrounding skin."

Disease from Soot.

In some way connected, and perhaps closely connected, with the action of crude paraffine on the skin, is the action of soot on the same surface of the body. In the old times, when the chimney-sweeper swept the chimney with his little human machines,—sweep-boys and youths,—and before the cleaner though still uncleanly habits of the sweep, as they now are, were introduced, there was often excited on the body of the worker in soot the peculiar and even fatal disease, which bears the name of soot-cancer. The disease is produced by the local action of the soot on the skin, and in extreme instances it is so severe that death occurs from it. The disease in these cases commences as an induration or hardening produced by the contact of the soot with the skin in parts where the skin is enfolded. This is followed by ulceration, and the ulcer is so difficult to heal and so often extends, involving more tissue, that it partakes, as I have said, of the character of a malignant ulcer or cancer. I have myself seen but one true example of this disease, and I learn that now it is rarely known amongst those who work in soot. The workmen are candid enough to admit that by attention to cleanliness, even in a moderate degree, they escape from injury. To be merely begrimed with soot does not suffice to produce actual ulceration; it is necessary for the soot to remain on the body for some time in accumulated quantity for it to produce mischief. Then it causes abrasion and soreness, and upon that the ulceration follows. There is an impression amongst the workers in soot that the quality of the soot makes a marked difference in the effects of it as an irritant to the skin. Soot derived from the burning of wood is believed to be more injurious than coal soot, and soot from swiftly-burning and slaty coal is held to be more injurious than that from good, solid, slow-burning coal that leaves little ash.

Disease from Vapor of Turpentine.

We are indebted to M. Marchal de Calvi for the first intimation that the vapor of turpentine produces a specific effect on those who are engaged in painting in oil and lead colors. Before his time it was considered that the lead in the paint was the cause of the disease. De Calvi proved that when the lead is fixed, the

emanations from the painted surface, which consist purely of turpentine, are exceedingly poisonous. He further pointed out that some workmen are specially affected through idiosyncrasy; in other words, that certain workmen are specially affected, but that all are liable to suffer. My own observations, made at various times since Calvi's announcement to the Academy of Sciences in Paris, on December 9, 1855, have fully confirmed his observations.

I have found marked symptoms in workmen using turpentine, especially when they are engaged in the process of "flatting." The symptoms are those of prostration, coldness, constipation, giddiness, headache, which lasts for many hours, impairment of appetite, and anæmia. These disorders are produced from the use of turpentine varnishes as well as from paints. Some workmen escape the action almost altogether; others are so susceptible that they will rather pay more favored men to perform the work than do it themselves.

The mode of action of turpentine on the body is not yet fully understood. Turpentine rapidly inhaled as a vapor produces sleep, like chloroform, and it has been used on an emergency as a substitute for chloroform in order to bring on anæsthesia. A key to its action was given some years ago by Dr. L. C. Roche, who, in commenting upon the researches of Marchal de Calvi, relates an interesting fact told to him by the illustrious chemist Thenard. It is that Thenard, having analyzed the atmospheric air of a cellar which had become poisonously charged with the vapor of turpentine, found that all the oxygen had been removed, and that nitrogen alone remained. Hence Roche assumes that turpentine produces its bad effects by depriving the air of oxygen. I believe this theory to be sound, but it does not explain all the facts. A more recent research by Dr. Liernsh has proved, by direct experiment, that turpentine vapor causes paralysis of the vessels of the minute circulation, with congestion of the brain and of the other large vascular organs.

Diseases from Mixed Vapors and Gases.

Workmen exposed to confined air in which organic vapors are evolved, are apt to suffer from disease. The workmen in wine docks are liable to this danger, a fact which I pointed out in my "Journal of Public Health," for 1855, after an inspection at the

London Wine Docks. I had been informed that serious unhealthiness prevailed amongst the dock men there, independently of the drinking habits which their occupation is liable to induce. My inspection showed that there was good ground for the suspicion of danger. I found the air close, and so charged with carbonic acid that in some recesses the lights burned dimly, while the whole atmosphere was tainted with vapor of alcoholic spirit. From the facts stated there can be no doubt that the men employed suffered severely from the effects of their occupation, that they contracted asthmatic coughs, lost appetite, became emaciated, and saw the end of life prematurely. On an average, ten years of constant service in the wine-vaults were more than sufficient to impair the health materially, and often completely. In one remarkable instance, however, a man worked twenty-seven years in the vaults without injury, but this was altogether an exceptional case.

BOOK II.

PART THE SECOND.

ACQUIRED DISEASES FROM PHYSICAL AGENCIES, MECHANICAL AND GENERAL.

CHAPTER I.

ACQUIRED DISEASES FROM DUSTS.

The first class of physical agencies by which diseases of the body are acquired may be included under the term "dusts." In this term we comprise those particles of solid matter which are mechanically suspended in the air, which settle on the body, which sometimes affect the eyes, and which are inhaled in breathing.

It is through the breathing organs, the lungs, that these dusts are most productive of injury; and it is among the industrial classes of the community that the injury produced is most frequent.

Dusts mechanically drawn into the lungs may induce true organic mischiefs, some of which, as we shall see, are of fatal character, although as a rule they are purely local in respect to their primary action on the body.

The dusts that inflict injury are of varied quality. They are also of varied effect in regard to the specific evils which they produce. We shall most conveniently study them as divided into different groups, according to their physical characters, as follows:

(*a*) Cutting dusts, formed of minute hard, crystallized particles which have sharp, cutting, and pointed edges. These dusts are composed of iron, steel, stone, sand, glass, dried silicates of earthen-ware, lime, pearl.

(*b*) Irritant dusts, derived from woods; from ivory; from textile fabrics, such as fluffs of wool, silk, cotton, flax, or hemp; from hair; from clay. Soluble saline dusts, derived from soluble crystalline substances.

(*c*) Obstructive and irritating dusts, composed of carbon, of fine particles of coal dust, of soot, of rouge, and of flour.

Diseases from Cutting Dusts.

When the particles of dust are made up of iron, stone, steel, sand, glass, or pearl, the danger is most immediate and most active. These particles, exceedingly minutely divided, are insoluble and are edged or pointed, so that they actually cut through the ciliary processes and the epithelial base on which the processes rest. I call them, therefore, cutting dusts. They are also heavy.

From these mechanical causes the injury such dusts inflict is as acute as it is terrible. Hence the rapidity of their fatal mischief to the knife-grinder, the stone-cutter, and the sand- or glass-paper maker. The symptoms induced are called, technically, symptoms of consumption. They are like the ordinary symptoms of that disease, and are, indeed, practically, the same, except that the foreign irritant which calls them forth is an inorganic particle, as distinguished from the organic tubercle of the natural affection. The rapidity of action of the particles of steel on the lungs is notorious in the history of the knife-grinders of Sheffield; and the late Dr. Alison of Edinburgh recorded of the masons of Edinburgh that he did not know an instance in which a hewer of stone, who had regular employment, was free from pulmonary symptoms up to the age of fifty.

Disease from Sand and Glass Dusts.

The most typical forms of disease of the lungs produced by the cutting dusts, which I have met with, have been amongst those who are employed in sand-paper making. Great improvements, by means of machinery, have been introduced of late into this process, but at one time the danger from it was imminent. The sand, or a mixture of minutely-powdered sand and glass, was placed in fine sieves, and youths were employed to distribute the powder, equally, over the paper. The work was light, and the young, therefore, were reckoned as competent for its performance. In one instance of a youth, who was under my observation from the early stage of his illness until his death, I traced the symptoms from the commencement. The youth was quite well until he went to this occupation, and on the first day he coughed severely from the irritation produced by the dust. When he returned home at night he still coughed, and complained of severe

pain in his side and chest. He continued, nevertheless, to toil on in his fatal work, but in a few days was stricken down with all the symptoms of acute pulmonary consumption. In the course of three weeks the symptoms had become so severe that life was rendered impossible, and within the month death took place. The symptoms were so closely allied to those of common pulmonary consumption, it would have been impossible to distinguish them from the ordinary disease but for the knowledge obtained as to their cause. The expectoration gave evidence, under the microscope, of the presence of the foreign irritating substance; and, after the death of the sufferer, the diseased lungs throughout their minute vesicular structures gave the same evidence, as the expectoration had, of the presence of the foreign particles. The mischief was nearly equally distributed over each lung.

I afterwards met with two other similar instances of fatal injury from the cause named. Of late, I have, I am happy to say, met with no repetitions of this experience.

Disease from Steel Dust.

In the work of the needle-pointers improvements have taken place of late years. Mr. R. Bartleet of Redditch, who has large numbers of needle-pointers under his observation, reports to me, under date of December 14th, 1875, respecting them, "that their occupation may now be considered very nearly, perhaps, taking all things into account, quite as healthy as the other branches of the trade. The work is now chiefly done by machinery, the workmen having merely to keep the stone, over which the needle wires are passed, in proper order and shape by frequently applying a piece of iron-stone to, and to see that the said wires are kept in proper order for travelling over the stone. A fan of considerable power is used to draw the dust away from the workman, so that it is his own fault if he inhales the dust. Careless men no doubt still suffer to a small extent, when not closely looked up by their employer or a foreman. These pointing machines have been in use about ten years, but the fans have been in use more than twenty years, and since their introduction it has been the fault of the men if they have suffered to any extent. Prior to the introduction of the fans the men seldom were able to continue work after about thirty years of age."

This, so far, is satisfactory; but needle manufacturers still

die at the rate of one hundred and twenty-three to one hundred representatives of seventy other defined occupations; while tool-makers, including knife-grinders, die at the rate of one hundred and twenty-one.

Disease from Earthen-ware Dust.

The dust which is diffused in the rooms where earthen-ware is manufactured, dust of clay, or rather the dust of a silicious material which is mixed with the clay, produces an action of two kinds. The dust which is given off in the earlier part of the manufacture, while the clay is but partly dried, acts rather as an obstructive than as an irritant. In a later period of the process, when the earthen-ware is becoming hard-dried, and the dust firmer, finer, and drier, more serious mischief is effected, for now the dust partakes almost of the character of fine sand, and the mischiefs induced are the same as those induced in the stone-cutters. One hundred and thirty-eight workers in earthen-ware, potters, die in proportion to one hundred following seventy other occupations. Bronchitis, consumption, and asthma are the diseases most common amongst these industrials.

Disease from Pearl Dust.

Pearl dust is a most injurious cutting substance, and pearl-workers, exceptionally, suffer. They are very numerous as a class in Vienna, and many of them also live in Birmingham and some other English towns. They usually work in their own rooms, which are small, ill-ventilated, incommodious, and stifling, so that the close conditions under which they labor are evils superadded to the labor itself.

The pearl dust which is distributed, mechanically, through the air of the work-room is comparatively a light dust, is readily wafted, is tasteless, inodorous, and, without creating much irritation in its passage into the lungs, is carried into the minuter ramifications of the bronchial tract, where, mixing with the secretion, it creates direct injury by its presence.

The direct injury induced in the manner described does not, however, include all that is effected of an injurious kind. Modern investigation has revealed another and most singular disease incident to the pearl-cutter. From the inhalation of fine particles of pearl there has been observed a peculiar inflammatory disease

of the bones, to which the name of "osteitis" has been given. This disease, first described by Englisch, as attacking mother-of-pearl turners, has since been studied by Gussenbauer, Klauser, Hert, and Merkel with much ability and originality of investigation.

The disease only attacks youths, before the skeleton is fully developed. It is characterized by sudden pain, which is neither increased by pressure nor motion. A swelling, first from the periosteum, or covering of the bone, and afterwards from the bone itself, commences at the ends of the bones at what are called the epiphyses. The soft elastic swelling is sometimes fluctuating; its development is accompanied by fever; it enlarges in the direction of the length of the bone, and, in time, it becomes harder, but rarely suppurates. As a rule the swelling subsides, but it often attacks several points of the skeleton at the same time, and it has a tendency to return. The bones that have been observed as affected, in seven cases under the observation of Gussenbauer, in youths from fourteen to sixteen years, are the radius of the arm, the ulna, the lower jaw-bone, and the thigh-bone. In one instance several bones were attacked successively in the same subject, viz., the left instep and the elbow, the left shoulder-blade, the left arm-bones, the cuboids, and the right astragalus or heel-bone.

Gussenbauer, to whom I am indebted for these descriptions, is of opinion that the malady is produced in the following manner. The pearl dust enters the lungs, penetrates the cellular structure of those organs and their lymphatic vessels and glands. Decomposed under the influence of the carbonic acid of the venous blood, the calcareous carbonates of the dust are dissolved, but its insoluble organic matter, which is a substance called conchyoline, discovered by M. Fremy, remains, penetrates the vessels, and is carried by the current of the arterial blood into the minute circulation. In the minute vessels of the bone at the epiphyses the substance finds resistance and deposits there, causing the swelling and other symptoms which have been described, and which continue until the foreign body is resolved and removed. Such is the modern ingenious theory of the origin and nature of the bone disease peculiar to the pearl-turner.

From the circumstance that the joints are the parts affected, and that the symptoms are those of pain, heat, redness, and swelling, the affection was conceived to be due, previous to the time

when the modern light was thrown upon it, to rheumatic or gouty tendency, though why such affection should attach specially to pearl-cutters was inexplicable. The mystery is now explained, and the explanation may possibly have a wider reading than at present appears.

Gussenbauer and Klauser have made an analysis of the three different layers of which the pearl-shell is composed. The most internal layer is the one used by mother-of-pearl turners. It contains of organic matter insoluble in water 5.57; of organic matter soluble in water 0.11; of water 0.47; of carbonate of lime 93.555; and of alkaline salts 0.295.

Disease from Irritant Dusts.

Some dusts are exceedingly irritating to the bronchial passages and to the minute vesicular structure of the lung without being actually cutting dusts. They are removed, in part, with the secretions, by the action of the beautiful ciliary apparatus which lines the mucous surface, and which wafting back the small particles of dust towards the throat, saves the lungs from injury, until, in fact, its own motion is impaired, or until it is overcome or destroyed by the actual weight of irritating material which is imposed upon it.

The dusts which may be included as irritant dusts are mechanically suspended in the air. They are common in work-rooms of persons engaged in a considerable number of industrial occupations, and are the causes of a large amount of suffering.

Disease from Wood and Ivory Dusts.

The dusts of some kinds of wood, to which turners of wood and cutters of wood are exposed, are causes of much irritation of the lungs, and of bronchial cough. The dust of wood is fine and penetrating, and when derived from colored wood imparts its own color to the bronchial secretion. I have seen severe phenomena of disease induced in mahogany carvers, and in those who turn ornaments for couches and other articles of furniture. The work gives rise to a great quantity of wood dust, which is freely inhaled. In turning, the artisan has to keep up a blowing process with the lips in order to blow away the small portions of wood which he removes with the tool. This process is wearying, but

the chief complaint made by the worker is of the dust he draws back in inhalation. The mischief is greatly increased in the rooms where the ventilation is imperfect. Cough, usually attended with copious secretion from the bronchial tubes, is set up, and I have more than once known the accompanying expectoration from this cause to be so free as to induce symptoms of wasting and exhaustion allied to phthisis pulmonalis, and constituting what has been called bronchial phthisis. As a rule, however, those who suffer from this form of disease get well when they are removed from their occupation and are placed under favorable circumstances for recovery.

These same observations extend to the phenomena observed as resulting from ivory dust, but I do not think I have ever seen in ivory turners or carvers symptoms equally severe with those that are presented by the artisans in wood.

Disease from Hair Dust.

Dr. Cholmeley has observed a peculiar bronchial irritation brought on in the carrying out of a comparatively new industry, namely, that of hair-brushing by machinery. The fine particles of hair carried off by the brush in its rapid revolutions give an atmosphere of dust which is extremely irritating, and which is carried into the face of the operator. Dr. Cholmeley has known three hair-dressers who have been obliged to leave their occupation, owing to the injuries that have been inflicted upon them from this cause. The wig-makers and hair-dressers are, as I have myself observed, subjected to a similar danger. The unhealthiness of all the occupations is shown by the rate of mortality in those who follow them. From the age of twenty-five onwards, the mortality of hair-dressers is one hundred and twenty-seven to one hundred of persons following seventy other occupations.

Disease from Cotton, Flax, and Hemp Dust.

The fine particles derived from cotton, flax, and hemp are irritating dusts, and, as we shall see, are different in their action from the dusts of wool and silk. The cotton flue produces bronchial irritation, but the worst injury results from the dust of hemp during the process of dressing it. The quantity of dust lost in hemp-dressing may be inferred from the fact that for every one hundred and twelve pounds weight of hemp employed

there is a loss of four pounds. This dust produces a severe bronchial irritation, attended with painful expectoration and strangling cough. Russian and Polish hemp produce these effects most intensely. Neapolitan hemp does the same, and something more. In the dust of the Neapolitan hemp there is distributed a peculiar odorous substance, the dust of some vegetable or grass, the inhalation of which causes shortness of breath, constriction of the throat, and spasmodic cough in recurring paroxysms which continue for many hours after the inhalation ceases. For the sake of experience I obtained a specimen of this hemp, and, after shaking it in a large bottle, I inhaled the dust. The symptoms induced were immediate. They resembled almost completely the symptoms of the disease known as "hay fever." I was unable by any examination of the hemp, microscopical or chemical, to detect the specific agent that was at work. Even dressing the hemp does not remove this substance, for the symptoms are common to the spinners of the hemp after it is dressed, although they may work in the open air.

The dust from flax dressing, which is in fact but a continuance of the hemp process on a finer material, is equally irritating, and the loss of flue in flax work is nearly the same as in the preparation of hemp. The ordinary symptoms produced by the dust of the hemp, and which are felt by the spinners as well as the dressers, are those of bronchial cough. The cough is not alike in all. In some it is dry and husky, in others it is a loose cough, with profuse secretion. One worker in this business, who had been engaged in dressing flax for thirty years, twelve years in the country and eighteen years in London, told me he had never met with a single fellow-workman who had not suffered more or less from this irritation; but that those who worked in the country suffered much less than those who worked in London. He had known a few who had lived to a fair old age. The work he considered to be much more easily carried on in warm and dry than in damp and cold weather. He had himself been a sufferer from the commencement of his business, and had been obliged, temporarily, to leave his employment on several occasions.

The condition of flax-workers continues still very unsatisfactory. Dr. Purdon of Belfast, one of the certifying surgeons under the Factory Act, reports, concerning the carders in the flax-working factories under his observation, that when a girl

under eighteen years gets a card, she very rarely lives beyond her thirtieth year if she keeps steadily at her occupation. She dies, as a rule, from consumption of the lungs.

Disease from Rag Dust.

In my *Journal of Public Health* for January, 1859, Mr. J. Jardine Murray, then of Edinburgh, and now of Brighton, reported a very valuable inquiry bearing on the health of those who work among rags, those who in "the inferior streets and alleys of the metropolis put out the tawdry stump doll, or the dirty bunch of parti-colored ribbons over the signboard, to indicate that the keeper of the dingy store is ever ready to give the highest price for all descriptions of rags and bones."

Mr. Murray expected, very naturally, that he should find amongst the workers in these tattered and filthy stores some suffering from contagion, others from the products of decay of the animal and vegetable constituents of the rags, others from inhaling and swallowing dust. An inquiry made by him at twenty-three paper-mills to which rags were sent, and of twenty-three rag collectors in Edinburgh, led to the curious return, that epidemic or contagious disease from this source was practically unknown amongst workers in rags, that there was no evidence of disease from the decomposition of the rags or the organic matter and dirt upon them, but that some workers suffered from bronchial affections, cough and shortness of breath, due to inhaling the dust which is cast off in large quantities from the rags when they are made to revolve in the wire-cloth cylinder to free them from dust.

Disease from Dusts and Fluffs of Textile Fabrics.

The particles of textile fabrics vary in their action, according to the substance of which they are composed. The particles of wool, fluffs of wool, appear to induce no really deleterious effects on the lungs; indeed, looking at the comparative mortality of workers in wool, we might almost say that they are favorably exempted from disease, as if the soft, oily dust of the wool rather protected the bronchial surface from irritation than irritated it.

To a considerable extent this same rule applies to the dust or fluff of silk, but I have seen an exception to this rule. In the trimming manufactories, where the business of carrying on silk-trimming is conducted in close rooms, I have found the workers

suffering from the same kind of bronchial irritation as that which obtains from the dust of wood. According to my observation, this only occurs when colored silk is used by the trimmer, and it is therefore possible that the dye-stuff used for the coloring may be the actual source of the mischief.

My attention was first attracted to this point by the circumstance of a young woman being brought to me who was supposed to be suffering from hæmoptysis, or spitting of blood. She was, in fact, expectorating freely something that seemed to be, at first sight, deeply tinged with blood. At the same time she exhibited no symptoms of disease which indicated consumption or other serious affection of the lungs, and was so healthy, generally, that except for a slight cough, it might have been assumed against her that she was simulating the very serious malady from which it was presumed she was suffering. I took the precaution to examine the colored secretion microscopically, and detected in it the fibre of silk, colored with red substance. On inquiry upon this, I found that the young woman was engaged in a trimming manufactory, in which red silk was being, at that time, largely used, and that she derived the red particles from the dust or flue which she inhaled. Other women in the same business were, I discovered, similarly affected, but suffered only from irritative cough when they were using red or other colored silks. White silks did not cause irritation, from which fact I draw the inference that the dye-stuff rather than the material is the irritant.

The mortality from workers in wool, cotton, and silk is, nevertheless, rather high, namely, one hundred and nine to one hundred as the mean of the seventy other occupations. The mortality of the draper who is exposed in his shop to the dusts of these substances is also high, namely, one hundred and eight. The mortality of those who work in cotton and flax is more remarkable; it stands at one hundred and fifteen as compared with one hundred as the mean or standard.

Disease from Copperas Dust.

Fine particles of some of the soluble salts of iron, especially copperas or sulphate of iron, are sometimes inhaled. One salt, copperas or sulphate of iron, which is used in fur dyeing for making the skins black, is in this way injurious. After the skins have been treated with a solution of the salt they are dried and beaten

with a bat, and thoroughly brushed. The copperas dust diffused freely through the air is an excessive temporary irritant to the lungs, but the solubility of it seems to reduce its power as a promoter of permanent disease in the lung tissue. Its action on the bronchial surface is therefore less destructive than that of many other irritating substances. Owing to its solubility, and to its corrosive action on bony substances, copperas dust is, however, destructive to the teeth, which are almost invariably affected by it. The teeth are rendered brittle, and generally carious. The grinding down of the color stuffs from the large crystals into the state of fine powder leads to similar bad results.

Diseases from Obstructing and Irritating Dusts.

There are other dusts, as I have stated in the beginning of the chapter, which, being drawn into the lungs, are indeed causes of irritation, but are injurious rather from the obstruction they produce than from the irritant effect. These dusts find their way into the structure of the lung and become embedded in it, rendering the tissue, in some instances, of the same color, and I had almost said of the same character, as themselves, and communicating similar characteristics to the expectorated secretion.

Disease from Carbon Dust.

The inhalation of carbon in the form of fine powder is a common evil attached to industrial labor. The coal-miners, the coal-heavers, and men who are exposed to some other occupations, such as walking-stick making, suffer from this dust. In the miner the lungs may become actually charged with the dust, so as to present, in very extreme examples, the appearance of a carbonized lung, but the carbon, as a rule, is to be considered as less destructive than steel dust, powdered glass, or stone.

The effects of carbon dust are characteristically seen in those who are engaged in charring and shading walking-sticks. The stick having been charred over a coke fire, the shading is conducted by removing the charred part by means of a fine rasp and sand-paper. An atmosphere of fine particles of dried carbon is produced, and the irritative action on the lungs is often severe. In the first stages the cough is attended with much suffering, but in time the cough loosens, and if the workman can be relieved of the

irritant with the secretion, the acute symptoms give way to a chronic cough. One of these workers, who was greatly reduced by the disease excited in this manner, told me very simply and clearly the facts in a sentence which I repeat. "It is all right," he said, referring to the charcoal dust, "it is all right when we can cough it up. If a man gets into that way he can stand his work for many years, but eventually the cough always masters us, and we break down."

Disease from Dust of Rouge.

In some occupations where the burnishing of metallic substance is carried on, much irritation and some obstruction is produced in the bronchial tubes by inhalation of the dust derived from the soft impalpable powder with which the polishing is effected. The powder of rouge is commonly used for this purpose. The powder is placed on a circular brush, which is made to turn in a lathe, and as the brush rapidly revolves, an atmosphere of dust is thrown in the face of the worker. The inhalation causes a slight bronchial irritation, and the expectoration of a phlegm which is often tinged of a rouge color; but the difficulty that is most complained of by the workmen, is a peculiar oppressiveness and obstruction of breathing, which, when it is once experienced, lasts for a long time, and is the cause of an all but persistent chronic cough.

Disease from Sulphur Dust.

In the great vine-producing district of the Hérault sulphur is employed to destroy the minute fungus called the oidium. The oidium is injurious to the vine, upon the stems and leaves of which it fixes, and, in order to destroy the parasite, sulphur is dispersed over the leaves of the vine, either with a fine sieve or with bellows which are made to blow it over. The effect of this process is to induce in the work-people who are employed in the task an ophthalmia or inflammation of the eyes. The pain, redness, and swelling of the eyes is most distinct and distressing in the middle of the day, when the heat and solar radiation is most intense. Women and children are the severest sufferers. We are indebted to M. Bouisson, of Montpelier, for the first description of this induced disease.

Disease from Flour Dust.

Flour dust is another of the obstructive as well as irritative dusts, and men who work in flour-mills afford, I think, the most striking illustrations of obstruction of breathing from the inhalation of minute particles of solid matter. The particles of flour produce, comparatively, little irritation, but they are carried readily from the larger bronchial tracts into the minute ramifications of the bronchial surface, and render the breathing irregular through parts of the lung. Thus an unequal pressure of the inspired air is brought about; an undue pressure is exercised upon some portion of the lung substance, ending in rupture or break of the minute vesicular structure, and therewith in the development of that disease of the lung which is, technically, called emphysema.

CHAPTER II.

ACQUIRED DISEASES FROM MECHANICAL PRESSURE OF THE LUNGS.

Caisson Disease.

In many industrial pursuits the lungs are subjected to extreme pressure or strain by which they are brought into a state of organic disease. Glass-blowers afford a common illustration of this class of injury. In their occupation, while blowing glass during the time it is in the molten state, their lungs, which are for the moment the blowers, are subjected to extreme strain. The deep inflation of the lung produces, after a time, extensive dilatation of the minute air tubes. The dilatation passes into permanent enlargement, and in workmen of not very advanced years is followed by rupture of the air vesicles, emphysema. When this accident occurs two sets of evils are established. The first is shortness of breath, because a portion of the lung is disabled, and the air in it is not duly expelled by the natural elastic contraction; in plain words, the lung is not efficiently filled and emptied. In the second place there is a deficient oxidation of the blood; a large volume of air taken into the lungs is not made available for respiratory purposes.

Under the influence of these two changes the person who is affected by them suffers from shortness of breath, paleness, coldness of the surface of the body, dyspepsia attended with considerable flatulency, debility, and comparatively early disablement. Persons so affected are also exceedingly liable to danger from accidental bronchial complications, such as bronchitis from cold or exposure to some other exhausting or debilitating cause.

Other classes of men than glass-blowers suffer in like manner from pressure upon the pulmonary structure. I notice among these, particularly, the workmen called paviors, who while engaged in laying stones use the heavy maul or instrument called

the rammer, which they lift up about half a foot from the ground, and then let fall upon the paved surface. From a curious habit these men as they let the rammer descend jerk out the air from their chests with a noisy effort, and then draw in a very deep breath. By this absurd process they produce dryness of the throat, hoarseness, a sense of exhaustion in the muscles of the chest, and a feeling of emptiness within the chest. After a few years the constant mechanical strain leads to dilatation of the bronchial tubes, rupture of the air vessels, and emphysema. The lives of these men are usually precarious and short.

Playing upon musical wind instruments is sometimes a cause of disease of the lungs, owing to the pressure which is maintained during long retention of the breath after deep inflation. It has been stated that players on wind instruments are less susceptible to severe forms of chest disease than are other persons. I can find no precise data to support this view, although it may be that those who are disposed to consumption of the lungs are benefited by any act which, in moderation, causes regular and deep inspiration. When I first commenced professional life, there was a physician living in London who made considerable reputation by the invention of what was commonly called a whistle or blow-tube, through which consumptive persons were taught to breathe deeply several times a day. It would seem that some good was really effected by this plan, and it is told of Cuvier, the great naturalist, that he, being threatened with consumption in his youth, was greatly benefited from reading aloud every day, by which the lungs were freely exercised and filled with air.

I think I have seen, for the same reason, some benefit from playing very moderately on a wind instrument. On the other hand, when such playing becomes a professed occupation, and the player is for many hours a day subject to over-distention of the lung, the delicate pulmonary structure is very soon apt to lose its elasticity and to become emphysematous. Bassoon, trombone, horn, and trumpet players are specially liable to these injuries, although the liability is not equally distributed amongst them. An intelligent bandmaster once explained to me why some suffer soon and others escape. It depends, he said, on the question whether the player has or has not learned the art of retaining a large volume of air in the mouth and throat, and of charging the distended parts from the nostrils while still playing. Some learn

this art so well it becomes with them an unconscious act, and their lungs are scarcely at all influenced. Others make a distended lung the reservoir, and, in fact, hold their breath all the time they are playing. It is these players who break down.

From holding the breath very closely in playing a wind instrument, the circulation through the lungs is sometimes impeded, and pressure of blood is thereby thrown on the right side of the heart. An amateur flute-player, whose history came under my observation, suffered from a very singular accident in this way. From the tension of holding his breath the right side of his heart was engorged, and the membrane which closes the foramen ovale or fœtal opening between the two auricles gave way. He became, thereupon, of dark color all over the body, cold, and subject to that form of disease described at page 136 as cyanosis, or blue skin disease.

In other instances the obstruction to the flow of blood on the right side of the heart during the process of playing prevents the due return of blood by the veins from the head, and leads to pressure of blood upon the brain with vertigo and nausea. I knew this to occur, in the case of an amateur clarionet-player, to such an extent that he was obliged to give up the practice. In youths who have been trained to band exercise one or other of the above-named symptoms is not unfrequently met with, and is an indication that the constitutional peculiarities are against the prosecution of the art.

Another curious disease from pressure is called "Caisson," or "Coffer-dam," disease. It belongs to an industry that is practically of modern introduction, and is brought about by the process of subjecting the body to great atmospheric pressure and afterwards suddenly relieving it from the pressure.

In laying piles of bridges and in some other similar works it is necessary to place the workmen in enclosed spaces beneath the level of the water, and to exclude the entrance of water by forcing air into the spaces in which the work is carried on. These enclosed spaces, or rather the tubes which form the enclosures, are called "caissons," or coffer-dams. In them the compressed atmosphere in which the workmen labor is confined, and to the diseased conditions which result in the men the term "Caisson disease" is applied.

The ordinary pressure of the atmosphere on man is fifteen

pounds to the square inch of surface of the body. Under that pressure all the functions of life are naturally carried on. In the caisson the air is pumped in with such force that an addition of two, three, and even four atmospheres may be maintained, under which additional pressure the workmen have to follow their avocation. If a workman can work ten hours under the ordinary pressure of one atmosphere, he can work five hours, or half the time, under two atmospheres, three hours and twenty minutes, or a third of the time, under three atmospheres, and two hours and a half, or a fourth of the time, under four atmospheres.

It was soon detected that when work was prosecuted under these pressures, some peculiar physiological changes were produced in the workers. It was observed that the blood in their veins became of the same red color as that in the arteries, that the breathing was quickened, that the action of the skin was profuse, and that when the men returned from their work to the ordinary atmospheric pressure they were subject to pains in their limbs, and to giddiness, with other symptoms of nervous disturbance.

The caisson disease has recently been most carefully studied by Dr. Andrew H. Smith of New York. Dr. Smith, whom I have the pleasure to know, has had an unexampled experience of the disease afforded to him while attending numbers of caisson laborers at a great work which has recently been carried out near to New York. The disease, he says, depends upon increased atmospheric pressure, but is always developed *after* the pressure is removed. It is characterized by extreme pain in one or more of the extremities, and sometimes in the trunk of the body, and this pain may or may not be associated with pain in the stomach and vomiting. In some cases the pain is accompanied by paralysis, more or less complete. The paralysis may be general or local, but is most frequently confined to the lower half of the body. Headache and vertigo are sometimes present. The above symptoms are connected, at least in the fatal cases, with congestion of the brain and spinal cord, often resulting in effusion of serum or of blood, with congestion of one or more of the abdominal organs. When sufficient time elapses before death there may even be softening of the brain in parts of that organ.

The one essential cause of the caisson disease, according to Dr. Smith, is the transition to the natural atmospheric pressure after a prolonged sojourn in a highly-condensed atmosphere. Without

this change the disease is never developed, and in some workers it is never developed at all, so that a special predisposition to it seems necessary.

The study of the caisson disease has led Dr. Smith to the opinion that it affords a key to the singular though very common predisposition to pains in the limbs on the approach of a storm. These pains are generally considered to be of a neuralgiac character, and to depend upon the dampness of the atmosphere. But, as the caisson disease affords examples of precisely the same pains, immensely intensified in degree, and resulting from the diminution of an atmospheric pressure to which the body had adapted itself, irrespective of any question of humidity, analogy suggests that the so-called neuralgiac cases are simply exaggerations of a predisposition identical in kind with the one under discussion, and produced, not by the influence of moisture, but by the low barometric condition of the atmosphere which precedes a storm. It is true that the change in the pressure is insignificant when compared with that which produces the caisson disease, but it is supplemented by the longer duration of the higher pressure to which the subject has been previously exposed.

CHAPTER III.

ACQUIRED DISEASES FROM MECHANICAL CONCUSSIONS AND SHOCKS.

The effect of repeated concussions upon the body is to produce a varied series of diseased conditions affecting various organs of the body. Iron plate workers, owing to the constant noise to which they are subjected, especially during the process of riveting, suffer much from the vibration. They are deafened by it, and in some instances are rendered permanently deaf. In other instances the circulation through the brain is disturbed, so that giddiness and nausea follow as results. These phenomena are produced in certain of the workmen much more readily than in others, and occasionally incapacitate them in the very outset of their career. Some experience a temporary annoyance which, after a time, they get over, the ear becoming less sensitive to the din. In a third class of cases the first oppression is tolerated, and the ear becomes accustomed to the vibration but slowly loses its natural capacity, so that deafness, more or less complete, is gradually established.

Another effect of repeated concussion in these workers, and in others who use the hammer in rapid smart strokes, is a vibration along the nervous cords passing from the hand to the brain. The concussion gives rise to a thrill which amounts in time to pain and numbness, ending in failure of readiness to hold or grasp the hammer. When this symptom is established it, usually, continues, and often renders the workman unable to follow his occupation.

The series of vibrations produced in railway travelling are not unfrequently severe in their results. In this mode of travelling there are several kinds of vibrations which tell upon the traveller. There is the shrill whistle at the railway station, which affects, through the organ of hearing, the whole of the nervous system. There is the vibration produced by the rolling of the carriages and

the collisions of one carriage with another in stopping; and, there is the constant vibration which is felt from the mere motion of the carriage as it rolls along.

By all railway travellers these symptoms are more or less experienced at first, but after a time, when travelling is very frequently repeated, they seem to pass away, as if the senses and sensibilities were deadened to them from use. It may be that in certain constitutions the bad effects are actually neutralized by habit, but it is more common that they are only concealed. In many persons, such as commercial travellers, guards, drivers, and stokers of the engines, who are the persons more particularly concerned, there is experienced after a time, if they are to suffer from the vibration, a sensation of thrill which extends along the spine, and which is uncomfortable if not actually painful. When this sensation is borne for several months or years, which is often the case, the digestive functions begin to fail, dizziness with frequent headaches supervene, followed, in the more determinate examples of disease, by want of power and by numbness in the lower limbs, with uncertainty of position and of pressure when the foot is brought to the ground. If the symptoms be noticed in time and promptly met they generally subside under rest and judicious treatment, but I have known them pass into complete failure of muscular power with premature break up of life.

Young children are often severely affected by the vibratory shrieking and tumult at the railway station.

More determinate and sudden concussions and shocks are inflicted on railway travellers by the severe collisions, which now and then occur. Under such concussions, though there may be no trace of actual physical injury, the nervous systems receive, sometimes, a shock so severe that it is never recovered from, or, if it be recovered from, only after a long interval of time. In some instances the ganglionic nervous system is the part that receives the shock, when the stomach and other digestive organs specially suffer. A sorter of letters in a mail van felt that the train was off the rails, and the van going at great speed down a decline. He seized a rope that was hanging from the centre of the van, hung by it, saved the direct shock which came, and showed no sign of bruise or blow. But he "spun round," as he expressed it, "like a top," and when he found his legs again was suffering an intolerable pain in his stomach and bowels, with violent attempts at vomiting. He came

under my care almost immediately afterwards, and though the pain subsided, the effects of the shock to the organic nervous system remained persistent. He lost all digestive power, suffered from continued intermittency of the heart, became emaciated, and finally succumbed. In other instances of shock the spinal cord is the part impressed, and want of power or actual failure, paralysis, of some of the groups of muscles supplied by the cord succeeds, although no visible physical injury has been inflicted. I have known an instance of this kind in which paralysis of the lower limbs lasted for ten years, and may possibly have continued longer, for the affected person, although I have lost sight of him, may be still alive.

In a third class of cases of concussion the brain is the organ that sustains the shock in one or other of its parts, upon which various kinds of cerebral symptoms follow, such as giddiness, nausea, noises in the head, irregular muscular movements amounting sometimes to epileptic seizure, or failure of nervous power. One common impression made upon the brain from these concussions is that of sense of repetition of the concussion followed by great excitement. In such cases various exciting causes will light up the panic. A little noise when falling asleep will be all sufficient. The hearing of a crash or fall, the rattle of a train or carriage, will be all sufficient. In the worst illustration of the kind the mere news or recital of an accident will light up the record of the impression with all its excitements and dreads, and will be followed with after excessive depression and local or general failure of nervous power.

The phenomena of sea-sickness may no doubt be placed under this same head in relation to cause. The effect of the motion of the vessel is to produce a series of shocks both to the ganglionic, or organic, as well as to the cerebro-spinal system. In some persons the organic nervous system is chiefly affected. They are easily made to vomit, and suffer as severely for the time as the patient of whom I spoke above who suspended himself by the cord in the railway carriage. They are slow to recover from the sickness; they lose appetite, and remain prostrate for many weeks, perhaps as long as the voyage lasts, and I have known at least one instance in which the sickness was never entirely recovered from during a comparatively long life. In other persons the shock tells most upon the brain and spinal cord. They are less

troubled with vomiting, but are oppressed with headache, giddiness, and inability to stand upright or move with steadiness. After they have completed the voyage these persons suffer still from unsteadiness in walking, feeling, as they express it, the movements of the vessel. On going to sleep they are for a time conscious of the same phenomenon, and are awakened by it, as if experiencing the pitching of the vessel. A repeated series of concussions have, as it were, affected the brain so as to leave an impression of a wave-like motion which does not subside until after a considerable length of time.

There are other kinds of concussion which determinately affect the heart and the circulatory system, as well as the nervous organism. The carpenter, who, by the way, enjoys a moderately healthy life, his rate of mortality being as ninety-one to the mean of a hundred of the other occupations, is subject to a concussion of a special kind from planing wood. This concussion extends through the chest, and causes a peculiar condition in the large artery, the sub-clavian, which runs under the collar-bone, so that if the stethoscope be placed over the artery, the pulsation of it is sure to be accompanied by a murmur of a harsh character. In course of time the effect of this concussion is felt also by the heart. The action of the heart becomes disturbed, irregular, and enfeebled. A similar state of things is induced in the wood-sawyer, in whom indeed the jerk connected with the act of sawing is brought to bear more distinctly and rapidly upon the heart.

Persons who have to ride much on horseback, and soldiers, such as artillerymen who ride on the gun-carriages, are subject, in like manner, to concussion, which is felt not only by the heart, but by the great blood-vessel which ascends from the heart, the ascending aorta. I have already explained at page 143 that in the old posting days aneurism of the aorta was so common among post-boys from this cause, that it was called "post-boy's disease."

The mode in which this concussion tells upon the heart is obvious enough. The whole column of blood from the right ventricle has first to ascend through the aorta. It is prevented finding its way back into the ventricle by the semlunar valves which lie across the orifice of the vessel; but in riding, with each bump upon the saddle, as it is called, the ascending column of blood is brought slightly back, by the concussion, upon the valves. This causes undue pressure upon the valves and undue pressure, from

within, upon the artery itself. The artery thus becomes gradually dilated, loses its elasticity, and is made the seat of the aneurismal affection. For these reasons almost all men who ride hard and long suffer from enlargement and failure of the aorta, if not from aneurism.

The effects of concussion may be so severe, in exceptional instances, as to cause a fatal accident in the way above described. The late Mr. Bloxam, of Duke Street, for many years my colleague, consulted me once in a case of this kind which led to an inquest. A plumber fell from a height, while doing some repairs to a window, and dropped direct upon his feet. He died shortly afterwards. We found that the cause of death was a small tear or rupture of the aorta, just above the aortic valves. The valves being closed at the moment of shock, the blood came down upon them, like the water hammer in the water pipe when the water comes down on the closed tap, and the vessel gave way.

Porters who carry heavy burdens, and waiters who carry weights up and down long flights of stairs, are exposed to the same dangers; and, in a more gradual but hardly less certain way, our steady and useful friends the postmen are similarly debited with disease from concussion.

CHAPTER IV.

ACQUIRED DISEASES FROM MUSCULAR OVERWORK AND STRAIN.

Muscular exercise carried out systematically and reasonably is an essential part of a healthy life. The muscles left inactive are exceedingly apt to undergo degenerative change, and to produce, in comparatively early life, a feebleness of body which is fatal to the full enjoyment of the term of life that is naturally allotted to us. But, useful as it is, muscular exercise may be carried to the extent of producing disease and of materially shortening the period of existence.

When muscular exertion is carried beyond what is reasonable, two unnatural conditions, one local, the other general, follow. The local unnatural change instituted belongs to the muscle or muscles subjected to the excessive work. We see this in the enlargement of particular muscles, as in the enlargement of the muscles in the arm of the blacksmith and in the leg of the dancer. We say that the muscles in this state are hypertrophied, and although they may be more competent, for a time, to perform the particular act for which they are employed, they are, in fact, out of harmony with the rest of the body, and are, therefore, in the strict sense of the word, diseased. Later on the local condition in the muscle or muscles thus overworked may change from a state of undue strength to one of deficiency of power. The muscular fibre may undergo degeneration, and be charged with new elements which have not the contractile property; or, it may undergo wasting of structure and loss of working capacity from that cause.

The general mischief which arises from over-muscular exertion is the most serious when it affects or influences the involuntary muscular organs on which life depends; the muscles and parts engaged in the circulation of the blood; the muscles of

respiration; and the organs of digestion. When once one of these fails, the failure of the body altogether is inevitable.

Sometimes the effect of muscular overwork tells primarily upon the body through the stomach. A person who is altogether in fair health becomes conscious of the fact after he has performed a certain amount of muscular labor which he may consider as not greatly in excess of his capacity, that he has a painful sinking and failure in the stomach which nothing but complete rest can rectify. Afterwards he is dyspeptic, and for some days loses his natural aptitude for taking and digesting food.

In another person the failure commences in the respiration. There is experienced after fatigue from muscular exertion some want of breathing power, a sense of weariness in breathing, a weight and oppression, or a tightness of the chest with a little cough and not uncommonly an ache, extending from the breast-bone through the chest, with a slight spasm. Nothing relieves this condition but rest, rest which may, perhaps, be required for several days.

In a third class of persons, and by far the largest class, the first signs of general failure are indicated through the circulation. The heart, it will be remembered, is itself a muscle. It is the central mover of the bodily life, and the physical life altogether rests upon it, if I may so express myself, as upon an inverted cone. Its work ever going on involuntarily night and day, cannot be disordered without communicating some derangement to the whole organism. The effect of this is, that the heart soon begins to undergo modification of structure under prolonged over-exertion. At first its nutrition is increased; then it becomes over-active and over-powerful, and in time holds a relationship to the body at large which is out of proportion, in respect of balance of power, with the rest of the body.

Presuming that the excessive exercise to which the heart is subjected is carried out early in life, while there is yet elasticity of the other vital organs, the body may adapt itself to the increased pressure and motion, and so, in the early period of completed life, the balance may be restored and a healthy balance secured. If it be asked, why should not this healthy balance remain? the answer is plain. It will not remain because the elasticity is not persistent. As the body becomes developed and its structures firm, the resistance to the stroke of the heart increases,

and the heart begins to bear a load which oppresses it beyond the work that is put upon it. Moreover, as its own nutrition becomes less active, its own elasticity is impaired. Thus it, in turn, gives way before the resistance. It becomes relatively feeble, and with its feebleness all the rest of the organism necessarily sympathizes.

In one of my studies I calculated up what may be considered the complete numerical value of the strokes of the heart of a person who has lived to fourscore years. The numerical value of beats or strokes may be fairly taken at about three billions, which will have been delivered at the rate of rather more than one hundred thousand per day. The heart which accomplished the three billions of beats in the eighty years is estimated, in this calculation, as performing a fairly natural life, and we will suppose that, according to the construction of the organism to which it belonged, it carried out its fully-allotted task. It worked eighty years and made the three billions of strokes, which was its limit of work done, in the time named. If it had been the heart of a postman, its work would have been increased a good fourth during the period of increased activity, and we may deduct from the time when its increased activity commenced a fourth of the value of the life. If then overwork commenced at twenty years of age, a fourth part of the remaining years due might fairly be deducted, bringing the duration of the life that should have been eighty years to sixty-five years.

I do not give this as more than an approximate calculation, but it is not far from the truth, and the day will come when calculations will be made sufficiently absolute to supply correct valuations for estimating the value of life in persons following all laborious muscular occupations.

In the cases where excessive muscular fatigue induces constitutional failure, leading to premature death through the circulation, the heart becomes enlarged in the first stage; the blood-vessels become unduly taxed in the second stage; the elasticity of the blood-vessels declines and resistance increases in the third stage; the heart becomes enfeebled in the fourth stage, degenerated in the fifth, and incompetent for its functions in the sixth. In a seventh and final stage, one of premature old age and decay, some of the other vital organs, lungs, liver, kidney, or brain, follow their leader in failure of function, and death closes the scene.

In certain instances it happens that the heart itself is the mus-

cular organ first affected by the exercise. Under the exertion the organ may suddenly fail altogether, losing its nervous power, and becoming intermittent or irregular in its action. I have known this accident to occur in the most varied ages of life; in youth, in full age, in mature, and in advanced age. Or the heart may undergo, from the first, an enlargement, may work with a force that is out of proportion to everything that is required of it, and may become a centre of disturbance to all the other systems of the body. This is by no means an uncommon result of excessive muscular effort and strain, and, indeed, I may state that amongst the many persons who have come before me suffering from over-physical endurance in its early stages there have been very few in whom the heart was not too large and too powerful. In later stages the enlarged and over-taxed heart is apt to undergo degeneration, to lose its contractile elements, and to become a centre of derangement to the body generally from failure rather than from excess of duty.

Disease from Athletic Strain.

Athletic exercises, while they are in themselves exceedingly useful, when practised in moderation, are often causes of danger to health. Even in those cases where the training includes the development of the whole of the body an extreme course of training may produce a strain or an ultimate degeneration which is most detrimental. We see such danger in the cases of men who at great self-sacrifice are, artificially, brought up to what is called perfection of work and endurance, as well as in men who are trained to perform particular feats, such as prize-fighting, rowing, running, foot-ball, and the like. There is a time in the life of those who are trained when it is considered that all parts of the body are equally developed, equally strong, equally active. I have no doubt that for a period during mature adolescence this point may be gained, but it is not lasting. There is no one human body so perfect, in conformation and in hereditary value of life through all parts of the body, as to be able to sustain equality of perfection for any length of time. There is no human pursuit so unvarying in its character as to demand an equal quantity of work from all organs of the body. Thus in a short time, after what is called complete training has been attained, there is

derangement in the body. One part fails while the other remains in full power, which means, virtually, disease, for one organ does not balance with the other. The late Mr. John Fernandez Clarke illustrated this point most admirably in an essay on the fatal illness of Heenan, the American prize-fighter. In Heenan systematized over-training destroyed the harmony of organic action. Heenan retained an imperfect general muscular power, an excessive circulating and breathing power with deficient assimilation. As a consequence the circulation itself became embarrassed, and the man broke up.

In athleticism there is still another danger. It would appear that when once the muscular organs have been brought to what is known as a high state of training, and have been maintained at this pitch for many months, they have been made to go through a stage of life which has told too determinately, as a tax, on their allotted life. In other words, they become prematurely old, have undergone changes as if from age, and thereupon have lost power. A knowledge of this fact is very old; it dates from the time when the athletic exercises of ancient Rome were transformed into causes of physical deterioration and of vital decay.

Some muscular exercises are at once injurious from the circumstance that they call parts of the muscular system irregularly into play. Rowing is one of these exercises when it is carried out as a systematic labor. In rowing the lower limbs of the body are steadily fixed, while the trunk of the body is moved backwards and forwards with every alternate position, and with great muscular exertion. The effect of this is to subject the thoracic and abdominal organs to special pressures. The blood-vessels of these parts are brought to their extreme limits of capacity for labor, and the heart has thrown upon it an amount of work which is disproportionate and beyond its power, if that be forced over a certain limited degree. Thus professed rowers frequently become affected with one or other of the diseases of the heart or circulation, called hypertrophy, dilatation, aneurismal enlargement, degeneration.

Running and walking against time also bring about their evils. In these exercises, carried to an extreme degree, the strain upon the lungs and heart is intense; and concussion, to which so much reference was made in the last chapter, is added to the strain. The heart in persons who carry out this athletic struggle becomes rapidly affected; it attains a large size at first, and is then ren-

dered irregular in its action, if not intermittent. Sometimes it is made intermittent with the first effort in running. One of the worst illustrations of this last accident is at present under my observation. The subject of it is a young man, twenty-three years of age, who was brought to what he very correctly termed "a dead stop" in his first great race, twelve months ago, and who, notwithstanding a marked improvement under absolute rest since, can never be expected to regain complete soundness of his circulation.

Occasionally during the exercise of running the breathing fails suddenly instead of the heart. Every runner knows that before he can steadily keep up his pace he must "get his wind," as he expresses it. When he starts to run his heart begins to beat in excess of his breathing, and his breathing consequently seems to be short or lost. By-and-by the heart reaches the height of its velocity, while the breathing muscles are brought up to their full pitch, so that there is established, by this means, an equal action between the two sets of vital organs, and, their balance restored, they go on together until they are exhausted, or until the limbs they supply with oxygenated blood are exhausted. Sometimes when the "wind has been got" the limbs fail first; but the wind is not always got; for when the runner has naturally a weak chest, weak muscles of respiration, or feeble lungs, the strain upon these organs is more than they can endure. Thereupon one of three accidents may happen. The diaphragm and other breathing muscles may become partly paralyzed by the effort; or some of the air vesicles of the lungs may give way under the pressure, producing emphysema; or some of the vessels of the lungs may give way, producing hæmoptysis, vomiting of blood. I have known all these diseased conditions induced by the athletic effort of running against time.

The game of foot-ball is another exercise which, violently carried out, leads to many dangers from muscular overwork and strain. It leads, perhaps, more than any other game to direct physical accidents from kicks, falls, and concussions; but apart from these accidents it combines with the dangers incident to running another danger which is very great, that of sudden cessation from active running in order to make the effort of kicking the ball. At the moment when the balance of the circulation and respiration is being, or is, established, there comes this sudden

check, by which a tremendous strain is thrown immediately upon the heart, under which that organ is, for a moment, checked altogether in its beat. The worst forms of heart disease I have ever seen in the young, as produced by athleticism, have sprung from this exercise. I had one boy under my care in whom the heart was brought by this cause to so large a size that as he lay in bed the bedclothes could be seen to vibrate from the impulses of the heart. He had to retain the recumbent position for a period of two years before the balance of the circulation was fully restored.

Disease from Muscular Strain in Mature Life.

Men who are engaged in arduous professions and businesses, and who during their first stages of manhood are occupied in making a living, often find themselves easily fatigued and wearied with the labors of the day. If they have been following a sedentary pursuit, their muscular organs, undergoing a slow waste and renovation, become the seats of effete and inactive material, and are wearied by very slight exertions. Some men in this position, being deficient in mental energy, and having practically lost the recollection of active exercise, nurse the weakness under which they are suffering, and let themselves fall into incapacity from actual degeneration of tissue. Other men of more resolute will plunge into exercise as a remedy, and finding at first great benefit therefrom, and discovering an ability for exercise which they imagined was altogether lost in their case, begin to cultivate efforts of a physical kind which are practically athletic in character, and which even in their younger days might not have been altogether judicious.

By this course the mature man entering into active physical work is apt to subject himself to disease. Up to a certain point he is doing the wisest thing possible; he may partly renew his youth by moderate exertion, but when he begins to lay a serious tax upon his remaining strength he almost inevitably comes to grief. This, in fact, is his natural fate under such circumstances. He has passed the time of life for making up, rapidly, his wasting tissues. He has arrived at the time of life when the elastic structures of his body have lost much of their elasticity. He has arrived at a time of life when, all parts of the body being duly formed, the facility for adaptation, under emergency, is impossi-

ble. He has arrived at a time of life at which it is all but certain that there is some irregularity in the systemic work of the organism. Everything, therefore, in the way of physical exertion ought to be like the work of his mind, active truly, but with careful measure of activity and without strain.

Not understanding these truths, the mature man will take to various exercises, in which he will often compete with young men, and feel a special pride in being their equal or superior competitor. He will join a volunteer corps, and go through drill and march after a hard day's work; he will take to the hunting field; he will become a yachtsman or a boatsman; he will exercise himself with long morning walks; or, worst freak of all, he will take to mountain climbing, and make that severe effort one of the competitive objects of his life.

In the pursuit of these efforts, which will be seen to be all somewhat akin, the risks are numerous. The heart very soon begins to suffer. It does not grow larger and stronger now, as it would have done in youth; it grows wearied and enfeebled after short efforts. The blood-vessels do not expand and contract as they did, but expand with imperfect contraction, gradually dilate, and sometimes suddenly give way. The lungs are rendered emphysematous under comparatively low pressure. The secreting organs, less ready and accommodating in function, are easily disturbed and made to act out of order. When the exhaustion is very great the digestion is enfeebled, and does not recuperate rapidly. Most important of all, the nervous system is more limited in respect to its sustaining power than it was in early life, and is given to fail locally, that is, in parts of the body, as well as generally.

There need be no wonder if amongst so many causes of mischief active results in the way of disease occur, under extreme exercise, in persons exposed to such risks. In one the failure commences in the heart, and is sudden, the action of the organ being rendered irregular or intermittent. In another the failure is in the blood-vessels, the large arteries near the heart becoming dilated, or the minute arteries, the arterioles of some distant organ, like the brain, becoming ruptured, with secondary results from the injury to the organ in which the accident has taken place. In a third person the lungs are made the seat of mischief; the bronchial tubes are dilated or the minute vesicles are ruptured

over a surface more or less extensive. In a fourth the liver or kidney becomes disturbed in function. In a fifth the stomach is affected and digestion rendered imperfect. In a sixth the nervous system is implicated, the brain fails to perform its active duties, so that mental weariness and somnolency are symptoms of frequent occurrence; or some special part of the body or limb loses its nervous power, and is said to be palsied or paralyzed.

In these brief notices I simply enumerate the more serious phenomena I have witnessed as results of muscular overwork and strain under the conditions specified.

In addition to the accidents named above is one other of a purely mechanical kind, which not unfrequently happens to persons of mature life who are undergoing severe muscular work. This is sudden rupture or tear of the fascia covering the muscles, particularly the muscles of the leg, an accident described on page 234 under the head "sprain."

Diseases from Muscular Strain induced by Industrial Occupations.

Many members of our industrial classes, navvies, brickmakers, bargemen, miners, coal-heavers, porters, hodmen, dock-laborers, carmen, and blacksmiths, owing to the nature of their occupations, are subjected to excessive muscular strain. Amongst these men the diseases incident to their occupation are more commonly connected with the heart than with any other organ. When they begin their work in early life, as is their common fate, the heart is at first enlarged and extremely strong. The enlargement renders them for a time capable of excessive exertion, but in the end this only leads to premature failure of the other organs of the body, and to that early break up which is so frequent amongst these classes of the industrial community.

When there is predisposition to chest affection in the workers, or when any special causes operating upon the lungs combine with those acting upon the heart, the failure may commence in the lungs; it often commences in lungs and heart simultaneously.

There is one remaining effect of excessive muscular exertion of a long-continued character which is local in its nature, and which must not be omitted in this place. I allude to paralysis of the hand produced by long-continued action of the muscles, an

affection described at page 177, under the head of local paralysis, as "scrivener's palsy." A similar kind of local paralysis, affecting the left hand, sometimes befalls the player on the violoncello, owing to the repeated and prolonged pressure exerted by the fingers on the strings of the instrument. One of our most distinguished violoncellists was for several months under my care with this form of paralysis previous to his death. The disease does not, as a rule, appear until there are signs of general failure of constitutional power.

Disease from Long-Continued Pressure.

Continued pressure from strained positions of the body may be productive of temporary or permanent symptoms of disease, even when the work which leads to it is comparatively light and actually sedentary. I have observed that writers who sit closely at the desk acquire, not unfrequently, the habit of leaning heavily forward upon the desk, so that the lower part of the breastbone is compressed. The compression may produce an actual deformity if it be caused early in life, and the effect of it is to interfere with digestion and to produce a sense of weakness which is, at times, very depressing. The fact of the pressure being made is almost always indicated by the mark or wear of the clothes which cover the part of the body that is pressed upon. The sedentary worker may therefore always know by this sign that it is time he learned to assume a less injurious position during hours of work.

Another strained position adopted by persons following sedentary pursuits is that of leaning heavily on the chair a little over towards one side of the body. This causes pressure upon the sciatic nerve on the side leaned upon, the result of which may be a sensation of numbness and want of muscular power in the limb below. I have known persons suffering from this cause taken with the fear that they were affected by paralysis.

CHAPTER V.

ACQUIRED DEFORMITIES AND DEFECTS OF THE BODY.

The body is subjected to various deformities and defects induced in different ways and connected with different organs or parts. Some of these deformities or defects are of trifling, others of the most serious moment. In certain instances the skeleton is the seat of the deformity, and, in the majority of instances of permanent deformity, the skeleton is involved. In other cases the muscular system is the part affected. In a third class the external membranous covering of the body, the skin, is the structure implicated.

In the chapters on the local affections of the different systems of the body we have already had before us many of these deformities and defects. At pages 244–245 the various deformities called curvature of the spine are described. At page 249 deformities connected with the teeth are detailed. At pages 235–237 different kinds of deformities connected with muscles and tendons, causing club foot, club hand, wry neck, and the like are described. At page 194 the deformity of the eye called strabismus or squint is explained, and at 268 some affections of the skin, which may be called defects or deformities, are brought under notice.

I need not do more than refer as above to these conditions of disease, and as they include the greater part of the common deformities and defects, I have little else to add to this chapter than a description of one or two deformities induced by practices of fashion and folly.

Acquired Deformities of the Chest.

In women the chest is too often subjected to deformity from the practice of compression either by the tight band round the waist or the tightly-laced corset. The tight band produces that peculiar wasp-like deformity and ugliness which is commonly

called the hour-glass waist. By systematic and increasing pressure of the band the floating ribs are brought closer together, and the space between the thorax and the cavity of the abdomen is reduced, often to an extraordinary degree below what is natural to it. The tightly-fitting corset includes a larger surface in its operation. It produces narrowing of the same region of the body as the band, though perhaps not so sharply, but it also includes a considerable portion of the chest, so that the size of that cavity is greatly reduced, to the serious limitation of the breathing space. The mischiefs resulting from these mechanically acquired deformities have been described over and over again by various writers, and I have more than once stated them before; but as they are most serious, and are still extant, I make no apology for restating them.

The effect of the pressure is equally injurious to the organs of digestion, respiration, and circulation. The liver and stomach are compressed, the digestive functions are impeded, and a distaste for solid food, with a difficulty to digest food, and with symptoms of pain and flatulency after eating, are the common proofs of the injury that is being inflicted. The great breathing muscle, the diaphragm, which separates the chest from the abdomen, and which, by its descent in contraction, causes the chest to fill with air, is impeded in its motion, and is therefore unable to sustain a free respiration. The large veins from the lower part of the body, which pour their blood into the right side of the heart, are compressed, and in the worst instances the heart itself and the lungs themselves are actually subjected to restraint.

By these means the organs of the circulation, not less than the organs of respiration and digestion, are disturbed, to the detriment of the whole of the body, which depends on these organs for its supplies of nervous and muscular force, and for its nutrition in every part. To the symptoms of indigestion are added breathlessness on slight exertion or excitement, coldness of the extremities, weakness of muscles, constipation, headache, and other evils not less severe.

The effects of mechanical pressure of the kind described are not confined to the mere periods of time at which the pressure is applied. They extend to after life, and when long continued, produce an imperfect build of the chest and of the trunk of the body which is never lost. Women thus deformed, when it is

their turn to become mothers, pay a penalty of suffering which would have been spared them if their bodies had developed into the healthy and beautiful form devised by the hand of Nature.

The evils arising from compression of the chest and body in early life are not exclusively restricted to the female sex. Schoolboys and youths constantly practise the habit of binding up their clothes round their bodies, by means of a belt tightened firmly above the hips, instead of wearing the brace over the shoulder. Some boys and youths are also taught the plan of putting on an extra belt for "holding in the breath," before they run or leap. In the pursuit of certain active businesses in which weights have to be carried, this same system of wearing a tight belt is adopted and practised by working men, until the artificial and ingenious support, as it is assumed to be, becomes, like the corset of the woman, a veritable injury.

To the belt the same objection applies as to the tight band and corset. It impedes the free motion of the abdominal organs; it impedes the freedom of the respiration; it interferes with the circulation in the young athletics who wear it while they are running, rowing, climbing, wrestling; it tends to bring on hernia, rupture.

Acquired Deformities of the Spine.

The spine is subjected to deformities from various acts by which it is made to maintain a bent position for long periods of time each day. This bending is, in some instances, connected with occupation. It is enforced in those who have to carry weights upon the head, such as market-garden men and women, itinerant fishmongers, men and women in some factories, and the like. It is enforced in men who have to carry heavy weights on their backs, such as luggage-porters, coal-heavers, millers, and hodmen. It is enforced in persons who are engaged in work requiring a stooping posture, as in the sawyer, the wheelwright, and especially the men who are employed at rivetting in cramped positions and in limited space. It is not infrequently induced in persons who are engaged for long hours at the desk, in writing and making calculations or drawings.

The spinal column under these unnatural positions loses its beautiful series of curves, and assumes one long fixed curve, the

concavity of which is anterior, the convexity posterior, to the body. The great organs of the chest and abdomen are not necessarily compressed by this deformity, but much muscular power, requisite for the full expansion and contraction of the chest in breathing, is lost. The gait also is considerably modified, and the capability of the lower limbs to maintain the erect position is decreased. Connected with the induced deformity there is, usually, general debility, and a loss not only of bodily elasticity but of nervous activity. The body, generally, is weakened, and is, as it looks to be, prematurely old.

Acquired Deformities of the Lower Limbs.

The lower limbs are subject to deformities arising from different sets of causes, some of which act upon the osseous or bony, others on the muscular, others on the circulatory system. The deformities connected with the bones of the lower limbs include those which arise from rickets, as described at page 241; contraction of the limb from abscess in the hip joint; dropsy of the knee joint; bow-leg, out-knee, and knock-knee affections described at page 244. Deformities of the muscles of the lower limbs include the varieties of talipes or club-foot, enlargement of the bursa of the patella, housemaid's-knee; bunion; and, rupture of muscular fascia; affections all explained in the chapter on the muscular system, pages 231–237.

These deformities are results of various mechanical influences telling upon the limbs, and combined, as a general fact, with constitutional defects and weaknesses.

Acquired Deformities of the Feet.

Other forms of tight pressure upon the body are open to serious, if not to equal, objection. The wearing of shoes which compress and distort the feet is a singularly injurious custom. The pointed shoe or boot is the most signal instance of a mischievous instrument designed for the torture of the foot. By this shoe the great toe is forced out of its proper line towards the other toes, giving a reverse curve, from what is natural, to the terminal part of the inner side of the foot, while all the other toes are compressed together towards the great toe, the whole producing a wedge-like form of foot which is altogether apart from

the natural. Such a foot has lost its expanse of tread; such a foot has lost its elastic resistance; such a foot has lost the strength of its arch, to a very considerable degree; such a foot, by the irregular and unusual pressure on certain points of its surface, has become hard at those points, and is easily affected with corns and bunions. Lastly, such a foot becomes badly nourished, and the pressure exerted upon it interferes with its circulation and nutrition. It ceases to be a member upon which the body can sustain itself with grace and with easiness of movement, even in early life; while in old age it becomes a foot which is absolutely unsafe, and which causes much of that irregular hobbling tread which often renders so peculiar the gait of persons who have passed their meridian.

It very often happens, that these mistakes in regard to the boot and shoe are for a time increased by the plan of raising the heel and letting it rest on a block of a pointed shape, "the peg top." Anything more barbarous can scarcely be conceived. By this means the body, which should naturally be balanced on a most beautiful arch, is placed on an inclined plane, and is only prevented from falling forwards by the action of the muscles which counterbalance the mechanical error. But all this is at the expense of lost muscular effort along the whole line of the muscular tracks, from the heels actually to the back of the head; a loss of force which is absolutely useless, and, as I have known in several cases, exhausting and painful. In addition to these evils arising from the pointed heeled boot, there are yet two more. In the first place, the elastic spring of the arch of the foot being broken, the vibration produced by its contact with the earth, at every step, causes a concussion which extends along the whole of the spinal column, and is sometimes very acutely felt. In the second place, the expanse of the foot being limited, the seizure of the earth by the foot is incomplete both in standing and in walking, so that it becomes a new art to learn how to stand erect or to walk with safety.

The mention of these deformities of the feet would hardly be complete without referring to that systematic deformity of the foot which is practised on the female population of China to this day, and which is brought about by bandaging or compressing the foot, in earliest life, so as to prevent growth. The foot of the Chinese woman, crippled by this process, is simply atrophied; it

retains, generally, its original shape, but it is really still the foot of a little child.

Acquired Deformities on the Surface of the Body.

Some pressures made on the surface of the body lead to deformities or defects which, though superficial only and limited, are not without their importance. The constriction on the leg produced by the garter is frequently made permanent. The pressure of the garter causes a line of depression round the limb, by which the course of the blood through the veins of the foot and leg into the body is impeded. This is one cause of varicose veins, sometimes an original cause, and always a serious impediment to recovery when, from any other reason, the enlarged or varicose vein is already present. The ligature or band called the garter is bad in any way, but is far worse when it is worn below than above the knee, for above the knee the two tendons, commonly called hamstrings, receive a great portion of the pressure, and act as bridges to the vessels which pass beneath.

In infants, during their first weeks of life, the cutaneous surface of the body is often rendered exceeding irritable by the process of tight swathing to which the little body is subjected. I have known sores to be produced by reason of this absurd practice, and a great deal of the discomfort or positive suffering which young children undergo in their first days spring from the chafing and pressure so inflicted. I have known the bad results of the swathing process extend even further. I have seen the body rendered temporarily misshapen from the same cause. The practice of swathing young children tightly is a mistake altogether, although it has probably been a custom from the earliest periods of history.

CHAPTER VI.

ACQUIRED DISEASES FROM PHYSICAL INJURIES.

A LARGE number of serious and often complicated affections happen to the body from common accidental causes, by which I mean causes brought about by something which man himself does, or is doing, or has done.

Various names are given to distinguish the nature of these accidents when they occur. If the body has received a blow in any part by which the surface is bruised but not broken, a *contusion* is said to have been inflicted. If the surface is actually divided or broken, the term *wound* is applied. If a tendon or muscle is displaced or injured, so that movement is interfered with, *sprain* is the word employed to express what has taken place. If a bone is broken, *fracture* is the term applied. If a bone is displaced at a joint, a *dislocation* is said to have occurred. If a foreign substance is carried into any part of the body and remains there it is said to be *impaction.* If from a wound an opening is formed communicating with some other part or organ, a *fistula* is declared to have been formed. If an internal organ like the bowel or the heart is torn as by a blow, *rupture* is the expression by which the result of the accident is defined. Should there be protrusion of a part of an organ from the cavity which contains it the word *hernia* explains the fact. Should the skin or mucous membrane be rubbed from the parts beneath the term *abrasion* is applied. Should the same surfaces be injured by fire *burns* are said to have been inflicted; should they be injured by heated water *scalds.*

These are the more general terms made use of in relation to common accidents, but they are often modified in order to express some additional effect. Thus a wound is *simple* if it be merely a clean cut; *perforating* if it go in deeply as into a cavity; *lacerated* if it be jagged; *contused* if it be connected with bruising or crush.

Fractures and dislocations of bones are *simple* when unattended with surrounding injury. But, when the fractured or dislocated bone is exposed at the broken part or its ends make their way into some adjacent organ, then the fractures or dislocations are said to be *compound*.

Injuries inflicted on the body receive also special names according to the manner in which they are produced. When they occur without foresight or intention they are called, simply, *accidental;* when they are produced for purposes of punishment, as by the infliction of the cat, they are called *judicial;* when they are inflicted by one person on another, they are called *homicidal;* when they are inflicted by a person on himself, or herself, they are called self-inflicted or *suicidal;* when they occur in conflict of armies or navies they are called *injuries* or *wounds of battle*, and are more minutely defined as *gunshot wounds*, *sword wounds*, *bayonet wounds*, and the like.

Physical Local Injuries.

Physical injuries affecting the body are once more defined according to the part or region of the body in which they occur. The official record defines them in this manner as injuries incident to the head, the face, the eye, the neck, the chest, the back, the pelvis, the upper extremities, the lower extremities, the absorbent system. It adds to these, injuries not classified; namely, rupture of muscle, rupture of tendon, and foreign substances in the cellular tissue. I present from the official record the following summary of these local injuries.

Injuries of the Head and Face.

The head is liable to contusion; to scalp wound in which the bone is not exposed; to scalp wound in which the bone is exposed; to concussion, or stun, in which the brain is involved, and some degree of unconsciousness caused. The head is also subject to fracture of the skull in the upper part or vault. Such fracture may be simple without depression, or simple with depression; or the fracture may be compound without depression, or compound with depression. The skull may also be fractured at its base, the part on which the brain rests; or it may be wounded as from gunshot, or other mode of perforation.

The brain may be subjected to local injury; it may protrude through an opening in the skull, hernia cerebri; it may be lacerated, with or without fracture; it may receive injury of its blood-vessels; it may have foreign bodies lodged in it; it may receive injury affecting the nerves which have their origin from it. Some of the most singular facts in the history of disease have been recorded in respect to the lodgment of foreign bodies in the substance of the brain. The late Dr. Day of Stafford has written an account of a man in whose brain a piece of a gun lock was lodged for many weeks, during a part of which time the man walked the distance between London and Stafford without seeming to be peculiarly affected, although he afterwards died from extension of disease through the brain. In other instances the brain has been exposed through an opening in the skull, and has remained covered with such thin cutaneous membrane that the pulsations of its vessels could be felt. I have recorded an instance of this kind in a man who lived in fair health for many years, and who ultimately died of an affection in which the brain was not involved.

The face is subject to contusion, wounds, and injuries of its blood-vessels. It is also subject to impaction of foreign bodies in its soft parts, and in organs or parts connected with it, as the ear, the nose, and the bony cavity in the cheek called the antrum. The bones of the face, including the lower jaw, are subject to fractures which may be simple or compound. The lower jaw is subject to dislocation, an accident which is easily remedied by the surgeon, but which is very apt to recur, from comparatively slight causes, when it has once happened.

Injuries of the Eye.

The eye is subject to simple contusion, commonly called black eye; to contusion with rupture to the external or sclerotic coat, ruptured globe; to contusion with displacement or dislocation of the crystalline lens; and to contusion with hemorrhage, or bleeding, into the globe. The eye is subject to impaction of foreign bodies in it or in its cavity. It is subject to wounds of its various parts; of the eyelid, the conjunctiva, or covering of the mucous membrane, the sclerotic coat, the cornea, the crystalline lens, the vitreous humor, and the iris or curtain. The eyelids and eye may be injured by chemical vapors or fluids; by burns and scalds. The globe of the eye may be dislocated, or displaced, or totally disor-

ganized by injury. Lastly, the parts within the orbit, including the glands, the muscles, the bones, and the optic nerve itself, may be wounded or injured.

Injuries of the Neck.

The neck is subject to contusion of the skin and soft parts beneath; to fracture of the hyoid bone at the upper part of the larynx, and to dislocation of that bone; to fracture of the cartilages of the larynx; and, to rupture of the trachea or windpipe. It may suffer from wounds on the surface,—superficial; deep wounds, as in cut throat; gunshot wounds; and, wounds from the mouth. Its vessels, arteries, and veins, including the carotid arteries and the jugular veins, are liable to injury. Its internal structures, the pharynx, œsophagus, larynx, and trachea are exposed to injuries from burns, scalds, and the action of corrosive substances. The same internal parts are sometimes injured by foreign bodies lodged or impacted in them.

Injuries of the Chest.

The external surface of the chest is subject to contusion and to superficial wounds, incised or lacerated. The bony structures of the chest, the ribs including their cartilages, are liable to fracture with or without injury to the lungs which they enclose. The sternum or breastbone is subject to fracture.

The parietes or walls of the chest may be the seat of wounds of various kinds; namely, simple wound, when the chest cavity is not penetrated; perforating, when the chest cavity is penetrated; penetrating, when the pleura or lung is wounded; mediastinal, when the central cavity between the two lungs, called the mediastinum, is penetrated; pericardial and cardiac, when the pericardium or covering of the heart or the heart itself is injured; and vascular, when some of the vessels in the cavity of the chest are included in the wound.

To these injuries of the chest are added rupture of the heart, or of the lung, with or without fracture of the bony surrounding framework.

Injuries of the Back.

Under the head of injuries of the back injuries affecting the whole spinal region are included, and are placed in the following order:—

(*a*) Contusion, involving the skin, and more or less of the soft parts beneath, and constituting sometimes very extensive bruises.

(*b*) Wounds, which may be simple and superficial; or deep and penetrating; and, in either case, incised or lacerated.

(*c*) Sprains, or injuries of the fascia, mischiefs induced by strain of the muscles of the back or of the fasciæ or membranous sheaths covering the muscles. The very painful injury called commonly crick, or rick in the back, or strain, followed by swelling and effusion, with inability to raise the body, and now and then with febrile excitement, is an accident of this nature.

(*d*) Fracture or dislocation of the spine, occurring in any of the regions of the spinal column, spinal, dorsal, or lumbar, and indicated technically according to the region, as spinal, dorsal, or lumbar fractures or dislocations. Such fractures or dislocations may be unattended or attended with injury to the spinal cord which is included in the spinal canal, the fact of injury to the cord being detected, as a general rule, by the phenomenon of paralysis which follows upon the infliction of the injury, and which extends to the parts supplied with nerves below the seat of the injury.

(*e*) Injury of the cord without known fracture, in which there are signs of nervous injury or shock without evidence of fracture or dislocation of any part of the spinal column. These injuries are often of the most perplexing character, and are classified by some under the terms *spinal shock*. They come frequently under notice in cases of railway accident, and are causes of much learned debate as to their nature and importance.

Injuries of the Abdomen.

The external surface of the abdomen is liable to contusion, which may be attended with rupture of the muscles beneath the surface, or even with rupture of the viscera included in the cavity of the abdomen, viz., the stomach, intestines, bladder, and, in the female, the uterus.

The abdomen is also subject to wounds of its parietes or walls, which may be superficial and incised, or lacerated, or penetrating into the cavity. When the wound penetrates into the cavity there may be protrusion of uninjured visceral organs, or of wounded or injured organs; or, the organs may be injured without protrusion. There may also be injury of the viscera without wound of the

parietes or walls of the abdomen. Again, there may be injury of the blood-vessels within the abdomen, with or without wound of the parietes.

Foreign bodies may be lodged in the peritoneal cavity of the abdomen, or in the cavities of the viscera, as in the stomach or intestine. Such foreign bodies may find their way into the cavities by external wounds, or they may be taken in by the mouth. Foreign substances carried into the body by a wound have occasionally been lodged, permanently, in the cavity, and becoming surrounded by organized material, have ceased to be causes of irritation. Foreign bodies swallowed have been known to make their way through the structures surrounding them, and to escape by an external opening or fistula. I have a patient still living from whom a plum-stone once escaped in this way by means of a fistulous abscess through the abdominal wall.

Another injury affecting the abdomen consists of an opening which communicates with the stomach or intestine, and constitutes an artificial orifice leading into the visceral cavity. A Canadian-Indian, called Alexis St. Martin, who died quite recently, afforded a remarkable illustration of this kind of injury. A great many years ago Alexis was wounded in the stomach, from without, and an opening was established from the outside of his body into his stomach, by which opening Dr. Beaumont was enabled to observe the course of the digestive process during life.

In cases of obtrusion of the bowels the surgeon sometimes makes a fistulous opening, and leaves it as a permanent artificial channel for relief.

Connected with the injury to the abdomen may be included injuries affecting the bladder, and the other organs and parts lying within the pelvis or basin which forms the floor of the abdominal cavity.

Injuries of the Upper Limbs or Extremities.

The upper limbs or extremities, including the collar-bone, shoulder-blade, humerus, ulna, radius, carpus, metacarpus, and phalanges, with their coverings of ligaments, muscles, tendons, membranes, blood-vessels, nerves, cellular tissue, and skin, are liable to a variety of injuries.

The skin and membranous parts are subject to contusions and wounds, to injuries of vessels and impaction of foreign bodies in

the soft parts. The muscles and tendons are subject to sprain or rupture. The bones are subject to separation of their epiphyses,—the ends of bones which in early life are separated from the shafts;—to green stick fracture or bending of bones; and, to fractures and dislocations which may be simple or compound.

The fractures of bones of the upper extremity may occur in the clavicle or collar-bone; in the scapula or shoulder-blade; in the humerus or arm-bone; in the radius or ulna of the fore-arm; or in the bones of the carpus, metacarpus, or phalanges. When, after fracture, there is not a proper reunion of bone, what is called a *false joint* may be the result.

Dislocations in the upper extremities may occur in the joint between the breastbone and clavicle, sterno-clavicular dislocation; in the joint between the collar-bone and the acromion process of the shoulder-blade, acromio-clavicular dislocation; in the shoulder-joint; in the elbow-joint; in the joint between the wrist and the carpus; in the thumb-joint; and in the phalangeal joints.

Injuries of the Lower Limbs or Extremities.

The lower limbs, including the innominate bone of the pelvis, the femur or thigh-bone, the tibia and fibula or leg-bones, the patella or knee-pan, the os calcis or heel-bone, the astragalus or ankle-bone, the tarsus, metatarsus, and phalanges, are subject to numerous injuries. The coverings of these parts, namely, the ligaments, muscles, tendons, membranes, blood-vessels, nerves, cellular tissue, and skin are also subject to numerous injuries.

The skin and soft parts are liable to contusions and wounds, to injuries of vessels, and to impaction of foreign bodies. The muscles and tendons are very subject to sprain and rupture. The fascia covering the muscles is subject to rupture. The epiphyses of the bones are subject to separation.

The bones are liable to fractures or dislocations, which may be simple or compound. The femur or leg-bone may be fractured in various ways. It may be fractured through its cervix or neck, an accident not unfrequently occurring, from slight causes, in persons of advanced age, either within the capsule of the joint, intracapsular, or below the capsule. The large prominence, or trochanter, at the upper and outer part of the femur is liable to fracture, and the bone may be fractured in various parts of its shaft. The patella or knee-pan is a bone subjected to fracture,

from severe strain with concussion, and is always very difficult to reunite, the fracture being usually across the bone from side to side. The tibia and fibula, leg-bones, are liable to be fractured either together or singly. The large leg-bone, or tibia, is most frequently fractured in the lower part. The smaller bone of the leg, or fibula, is sometimes fractured alone, at a little distance above the ankle-joint, from comparatively slight causes, as from blows or kicks on the outer side of the ankle, and from twisting of the foot during falls. This fracture of the fibula is called "Pott's fracture," after the distinguished surgeon who first described it.

The bones of the feet may undergo fracture, simple or compound. Fractures of the bones of the lower limbs may, under untoward circumstances for reunion, remain ununited, and give rise to false joint.

The dislocations, simple or compound, occurring in the lower limbs are, dislocation of the hip, of the patella or knee-pan, of the fibula or smaller leg-bone, of the foot at the ankle, of the foot at the joint of the heel-bone and astragalus, of the astragalus, of the heel-bone, of the tarsal bones, and of the metatarsal bones and phalanges.

Injuries of the Absorbent System.

The absorbent or glandular system is exposed to various injuries. Foreign bodies may be lodged in the glandular structures; concretions or calculi may be formed in the glands. The lymphatic vessels may be compressed, contused, or wounded. In some forms of poisoned wound the lymphatic vessels are largely involved in the accident and become the seats of acute inflammation, which is marked out in distinct lines describing the course of the lymphatic canals; this condition is called, in common language, inflammation of the absorbents from a wound.

Unclassified Injuries. Burns and Scalds.

Ruptures of muscles and ruptures of tendons are called, officially, unclassified injuries. They have been before us in treating of the diseases and injuries affecting the muscular system.

Under this head of unclassified injuries may be included the lodgment of foreign substances in the cellular tissue of the body.

Under this same head may also be included the injuries in-

duced by burns and scalds, accidents, affecting chiefly the outer or cutaneous surface of the body, often ending fatally, and inflicting the most appalling injuries upon certain classes of the industrial populations. When I was collecting the facts for a medical history of Wolverhampton, I found that cases of burn were introduced at the hospital there at the rate of three per week from the month of October until May. The burns were about equally divided amongst the sexes and amongst children and adults.

Burns and scalds affecting large surfaces of the body often kill directly from the shock they produce. In other instances life is prolonged, to terminate at last in death caused either by exhaustion and pain or by decomposition of structure and secondary absorption of decomposed matter. In a third class of cases life is preserved, but the burned surface is left covered with hard cicatrices or with contractions of the skin which, of all deformities, are amongst the most difficult to remove.

Since the introduction of electricity into the Arts severe burns and even fatal shocks are now sometimes sustained by those who are brought into contact with the conducting wires of the electric current.

CHAPTER VII.

SURGICAL OPERATIONS.

Surgical operations, although they can scarcely be considered as induced diseases, because they are performed under necessity, yield nevertheless a certain mortality, and must not therefore be passed over without mention. The success or failure ending in death from surgical operations rests upon many circumstances. The skill of the surgeon naturally plays a very important part. Various details in the performance of an operation, some of which may seem at first sight almost trivial, play a part equally important. The age of the patient often determines the result, the rule being that the chances of recovery from an important operation are lessened in proportion as the age of the person is advanced, although to this rule there are often striking exceptions. The constitution and condition of the patient are other factors influencing results. Persons who have led luxurious lives succumb more easily than the abstinent and the hardy to surgical operations; while those who have indulged largely in alcoholic drinks, and in whom the kidneys and other glandular organs are affected from that cause, become the dread of the operator. Lastly,—as I have shown in an essay on the subject,—various meteorological or atmospherical conditions of an unfavorable kind tend to increase the mortality incident to surgical procedure.

In a certain sense, therefore, we are forced to look upon surgical interference, conducted with the best and most skilful art, as an induced injury to the body, although induced, of course, to correct injuries or diseases of still graver import. In this sense a brief history of the more important operations, referred to in the official record, is deserving of a place in these pages. We may here follow the plan adopted in the part relating to local diseases; and the various kinds of operation as they affect the various grand systemic portions of the body.

Operations on Systemic Divisions of the Body.

Operations on Parts connected with the Digestive System.

A large number of operations have to be performed on parts connected with the digestive canal. Removal of portions of the lip for cancerous disease; removal of salivary calculus, of epulis, and other growths connected with the gums; lancing of the gums for gum-boil; extraction of the teeth; removal of the whole or portion of the tongue for malignant disease of that organ; operation on the roof of the mouth for closing the opening called cleft palate; lancing of the tonsils for abscess in them; removal of the tonsils by excision: these are some of the more important operations performnd on the parts of the alimentary canal called the mouth and throat.

The œsophagus, or gullet, is sometimes subjected to surgical procedure. In cases where the œsophageal tube is the seat of obstruction or of stricture, attempts have to be made to dilate the tube in order that food may be passed into the stomach through the dilated opening, or through a tube passed beyond the obstruction. In some extreme cases the operation called *œsophagotomy*, or the making a direct opening into the œsophagus for the purpose of introducing food into the stomach, has been resorted to.

The stomach, in extreme cases, may have to be subjected to the operation of *gastrotomy*, that is, the operation of opening it for the purpose of introducing food; and, desperate as the operation is, it has been performed with success. Among the remarkable instances on record in which this operation has been, if I may so say, accidentally performed, is that of Alexis St. Martin, who, as stated above, lived with an artificial opening from the outside of the body into the stomach. The abdomen has, occasionally, to be subjected to the operation of tapping, *paracentesis*, in order to draw off dropsical fluid which has accumulated in the peritoneal cavity.

Section of the abdominal cavity, with the object of making an exploration of the canal in cases of obstruction or tumor, has often been resorted to, and of late years, since the operation of ovariotomy has been so perfected, this formidable procedure has been carried out with greater boldness, skill, and success than was ever for a moment considered possible in past times. For the

purpose of removing obstruction and for allowing the contents of the abdomen to find an outlet, the operation called *colotomy*, or the opening of the larger bowel, has been introduced. The operation is carried out either from the groin or inguinal region, or from the back or lumbar region, and is called respectively *inguinal* or *lumbar* colotomy. It is a surgical procedure which is often eminently successful in its results.

Operations for hernia, the nature of which affection is described at pages 119–21, have very frequently to be resorted to. In these operations the skin and soft parts are divided down to the seat of the stricture of the intestine, after which the constricting ring is divided so as to enable the intestine or other protruding portion to be pushed back into the abdominal cavity. In certain instances the sac or peritoneal covering of the bowel is returned with the other parts without being opened; in other instances the sac has to be opened. There is also an operation called theoperation for the radical cure of rupture or of hernia, by which the attempt is made to close, permanently, the open ring through which the bowel is wont to protrude from the abdominal cavity.

Operations have to be performed on the lower bowel for constriction or stricture of it; for relief of permanent spasm of the circular band of muscular fibres called the sphincter; for laying open a fistula; for relieving painful cleft or fissure; for removal of hemorrhoids; and, occasionally, for arrest of hemorrhage or loss of blood from the bowel. Removal of tumors and of foreign substances from the same part is a surgical procedure which is sometimes necessary, as is also the attempt to dilate the intestine by artificial means when there is serious obstruction in the passage of the intestinal canal.

Operations on Parts connected with the Circulatory System.

Many surgical operations have to be performed on different portions of the circulatory system. Bleeding arteries have to be subjected to the ligature, tied; or, a main artery has for a time to be subjected to compression in order to prevent bleeding; or, a small artery, as in a tooth, has to be put under firm compression at the bleeding point; or, where an artery cannot be tied it may be necessary to apply the actual cautery or hot iron to suppress the bleeding. Different modifications in the method of stopping the bleeding from arteries have been introduced of late years; these

methods include the twisting or *torsion* of the bleeding vessel; or the introduction of a needle transversely beneath the vessel, as the stem of a flower is held in the coat by a pin, *acupressure.* Bleeding, when it takes place from a number of vessels in a cavity, such as the nose, is commonly arrested by what is called the plug, which consists, in most cases, of cotton wool or other soft substance charged with some styptic solution and pressed firmly into the bleeding part.

The disease of the blood-vessels, called aneurism, described in pages 142–3, is often treated by means of surgical operation, and is usually so treated when the aneurism is sufficiently external to come within reach of surgical art. Compression of the artery which feeds the aneurism, by which the aneurismal tumor is for a long time deprived of the entrance of blood, is one of these operations; tying the artery above the aneurism is another method; laying open the aneurism and tying the vessel immediately above it is a third but now almost exploded plan. Compressing the aneurism when it is in the flexure of a joint by bending the joint and keeping it bent for a long time, is a fourth procedure which has been very successful in the case of popliteal aneurism, or that aneurism which occurs in the popliteal space at the back of the knee joint. Inducing coagulation of the blood in the aneurismal pouch or sac is a fifth method, the introduction of a styptic solution or of a galvanic cautery into the pouch being the means employed for the purpose. Of these many methods that of tying the vessel at some part between the heart and the aneurism is, when it can be effected, the most approved; and many of the larger arteries of the body,—the brachials, the subclavians, the carotids, the iliacs, and the femorals,—have been subjected to the ligature with success.

The veins have to be operated upon in some forms of disease. Bleeding from a vein has to be prevented by compression on the vein below the bleeding part, so as to check the current of blood returning by the vein to the heart. Enlarged or varicose veins have to be operated on in certain cases, either by compression, subcutaneous incision, or ligature. The enlargement of vein called varicocele is sometimes subjected to operation by the process of obliterating the main venous trunk which supplies the plexus or congeries of small veins, or the dilated large vein which forms the vascular swelling.

Other vascular enlargements, especially that known as nævus, described at page 145 as a vascular growth on the skin, consisting of a series of small capillary vessels, have to be treated by surgical means. Tying these vascular tumors is one method; treating them by means of puncture with a hot needle point is another; exposing them to the action of caustics is a third method; subjecting them to the action of ethylate of sodium is a fourth method, introduced by myself, and one which is now rather largely employed.

Operations on Parts connected with the Respiratory System.

It is necessary in some instances where there is obstruction to the breathing in the larynx or the trachea, to perform the operation of opening one of those parts in order to allow the sufferer to breathe from below the seat of the obstruction. This operation, often most brilliant in its results, was described by an ancient surgeon, named Antyllus, with a precision that leaves little to be desired. In certain cases it is found advisable to make the opening into the main air passage leading into the lung through the larynx; when the operation is called *laryngotomy*. In other instances it is found advisable to perform the operation lower down, that is to say, through the trachea; this is called *tracheotomy*. Laryngotomy and tracheotomy are resorted to most commonly for obstructions produced by croup, diphtheria, and inflammation of the mucous membrane. They are sometimes resorted to to relieve breathing when some foreign substance has got into the windpipe, or for the removal of foreign substances.

The chest has sometimes to be subjected to the operation of tapping, in order to let out fluids contained in it. When dropsy occurs in the pleural cavity of the chest, tapping may have to be performed for the purpose of drawing off the fluid which oppresses the lung. The same operation may have to be performed when pus or purulent matter has accumulated in the cavity of the pleura. In like manner the bag or pericardium surrounding the heart may, in rare cases, have to be tapped to relieve the pressure arising from excessive pericardial secretion.

Operations on Parts connected with the Nervous System and Organs of the Senses.

It has been considered necessary, occasionally, in cases of accumulation of fluid in the cavities of the brain, to carry out the op-

eration of tapping,—*paracentesis*, in order to relieve the pressure. The same operation has been resorted to in the spinal cord for the disease described at page 176 as spina bifida.

It has been thought necessary in some cases of severe nervous pain, persistent neuralgia, and in some cases of severe spasm, tetanus, to perform the operation of dividing a nerve,—*neurotomy*. It has been thought necessary also in some cases, although the measure is more doubtful, to perform the operation of stretching a nervous cord. But, taking it all in all, surgical interference on nervous structures is rarely resorted to.

Operations on certain of the organs of the senses are of common occurrence. On the eye and its appendages between twenty and thirty operations are performed. Entropium, or inversion of the eyelid, and ectropium, or eversion, are remedied by operation. Ingrowing eyelash, trichiasis, is in like manner remedied. Growths attached to the eyelids have to be removed by the knife or other surgical procedure.

When the eye is subject to squint, strabismus, a skilful operation is carried out by which the shortened muscle, within the orbit, which pulls the eye out of place, is divided near the point of its membranous attachment to the eyeball. When the lachrymal duct, which leads from the eye into the cavity of the nose, is obstructed, it is reopened by operation.

Various operations are performed upon the eyeball itself. An artificial pupil may have to be made. A portion of the iris, or curtain, may have to be removed by what is called the operation of *iridectomy*. For cataract and other diseased conditions of the crystalline lens many procedures are adopted. The lens may be broken up, it may be depressed or pushed out of the axis of vision, it may be extracted.

Foreign bodies may require to be abstracted from the eye. The globe of the eye may require to be tapped to relieve accumulation of fluid.

Lastly, it may be necessary to carry out what is called *excision* of the eyeball, in which operation the excision may be partial, or total. When total, it may or may not include the other structures contained in the orbit.

The organ of hearing is subjected to certain operations. Polypus growths, or concretions of wax, or foreign substances

may have to be removed from the external canal which leads from the outer surface of the body to the tympanum. Portions of dead bone may have to be extracted from the same canal. The drum may require to be tapped or perforated. An artificial drum may have to be introduced. The tube leading from the throat into the middle ear, the Eustachian tube, sometimes requires to be probed or injected to remove obstruction.

Operations on Parts connected with the Glandular System.

A considerable number of surgical operations are called for in connection with the glandular system. The salivary glands in the mouth which secrete the saliva have sometimes to be relieved of calculus or hard concretion. The liver, in case of abscess of it, may have to be tapped. The gall bladder has been opened, in order to relieve it of gall stones.

The kidney on one side of the body, in some instances of disease of it, has been relieved of calculus by operation, and several times the whole organ has been successfully removed. The bladder, which is the pouch or reservoir of the kidney, is subjected to operations of various kinds. It has sometimes to be tapped; but the operations on it that are most common are those for the removal of stone or calculus. By one series of these operations, *lithotomy*, the calculus is removed entire, the method for removal being (*a*) the high operation, supra-pubic; (*b*) the lateral; (*c*) the bi-lateral; (*d*) the median; (*e*) the recto-perineal. In another series of operations, called *lithotrity*, the calculus is removed by an instrument which, passed into the bladder by the usual passage, is made to seize the stone and break it into small fragments, so that it can be washed out from the cavity. These operations are now brought to a state of great perfection.

The prostate gland in the male subject may have to be operated upon for the removal of calculus.

In the female subject the glandular organ called the ovary in examples of dropsy of that structure has to be tapped under some conditions; but, the most important operation connected with disease of this organ, described at page 221, is that of *ovariotomy* or removal of the diseased ovary altogether.

The breast may be subject to incision in order to allow the escape of matter from it when it is suffering from abscess. It may have to be tapped to remove fluids from cysts. It may have to

be removed altogether for cancerous or malignant disease affecting it.

Certain of the ductless glands are operated upon under special circumstances. The gland in the neck called the thyroid, which by its enlargement produces the disease known as goître, is sometimes tapped in order to be relieved from fluid contained in cysts in its structure. The gland has been subjected to injection and to the needle cautery for destruction of parts of it. It has been partly and wholly excised.

The large ductless gland in the abdomen called the spleen has been removed for disease affecting it, and, on more than one occasion, with successful results.

Operations on Parts connected with the Muscular System.

A muscle is sometimes partly or wholly divided, but the most important series of operations connected with the muscular system are those of divisions of tendons of muscles, by the process called *tenotomy*. These divisions of tendons are subcutaneous operations; that is to say, the tendon is divided by means of a very fine knife which is introduced beneath it by a small opening through the skin. Great success in the relief of deformities of the body has attended these skilful and useful operations.

Operations on Parts connected with the Osseous or Bony System.

The joints connected with the osseous system or skeleton are involved in many surgical procedures. Dislocations of joints have to be reduced so as to bring the disjointed parts back to their original positions. Stiff and deformed joints have to be extended and moved in order that they may regain some part of their natural motion. A joint, such as the knee or elbow joint, may have to be *incised*, and, under certain conditions, these large joints may have to be *excised* or removed completely. Loose bodies within a joint may also have to be removed.

Bones may require to be excised altogether or in part, in consequence of disease of their structure or of injury to them. The bones of the skull may have to be perforated with a circular cutting saw or trephine, in order to relieve pressure within the skull; or a piece of depressed bone of the skull may require to be lifted up also for the purpose of relieving pressure. A fractured long

bone that has not properly reunited is sometimes operated upon in order to induce reunion. A long bone that has been fractured and has united in a useless or deformed manner may have to be refractured and reset.

Recently the art of dividing bones subcutaneously has been introduced into surgery, and deformities connected with large long bones have been rectified by division of the bone through a small opening sufficient only for the introduction of a delicately-cutting saw. Mr. William Adams has divided the neck of the femur or thigh-bone successfully by this operation.

Operations on the Skin and Subjacent Structures.

Numerous operations are performed on the skin and on the passages of mucous membrane which dip into it. Tumors of different characters have to be removed from beneath the skin; unnatural clefts and divisions through it and the mucous membrane connected with it, as in harelip, have to be incised and brought together with a stitch or suture; fistulous openings through it into subjacent parts have to be incised. Cicatrices, or scars, as those arising from burns, may require to be scored or divided. Webbed and contracted fingers or toes may have to be scored or divided. Loose growths may have to be removed from the skin. Ulcerated surfaces may require caustics or other surgical treatment.

Unclassified Operations.

There remain still a number of unclassified operations which require brief notice.

Amputations, or removal of large portions of the body occur in surgical practice, and are classed under different heads. When an amputation is required immediately after an accident, it is called a *primary* amputation; when it follows a preceding one, it is called a *secondary* amputation; when it is done to remove a long-standing disease, or deformity, it is said to be an *amputation* for *disease* or *deformity*. When an amputation includes a larger part of the body, as the shoulder-joint, the arm, the fore-arm, the hand, the hip-joint, the thigh, the knee-joint, the leg, the ankle-joint, the foot, the breast, it is said to be a *major* amputation. When it includes the smaller joints, such as the fingers and toes, it is said to be a *minor* amputation. These

distinctions of major and minor are the same, whether the amputation be primary or secondary, or for accident, disease, or deformity.

Transfusion is an operation by which blood is transmitted from the vessels of one animal into those of another, or by which other fluids than blood are passed into the circulation. Transfusion of blood, usually from the veins of the person supplying to those of the person receiving it, has been attempted with varying successes for over two hundred years, in cases of fever, and in cases of hemorrhage or loss of blood. Transfusion of saline solutions into the veins has been practised with remarkable results, but little corresponding success, on persons suffering from cholera. In 1852 I proposed to substitute injection of saline fluids in cholera by the peritoneum instead of by the veins, but with results which were not much more promising.

Artificial respiration is a procedure for sustaining the failing natural respiration, or for re-starting the respiration after it has entirely ceased. In the cases of persons who have been drowned, or who have succumbed to narcotic vapors or to other influences that interrupt the breathing, artificial respiration is employed.

The operation is extremely valuable, and is the means of saving many lives from the most imminent peril of death. It is usually performed through the mouth or nostril. In exceptional cases it is performed through an opening in the windpipe.

Cæsarean section, so called because the mother of Julius Cæsar was said to have been subjected to it at his birth, is an operation performed during childbirth, when the birth cannot take place in the natural way. It consists in making an incision through the abdomen into the uterus or womb of the mother, and of delivering the child with the after-birth through the artificial opening. The operation has been many times performed with successful issue, the lives both of the mother and child being sometimes saved.

Special Diseases from Surgical Operations.

The special diseases or conditions of disease which follow upon surgical operations are not extensive as a class, but are, unfortunately, of serious moment when they arise.

Shock.—The most immediate of the bad results from a surgi-

cal operation is what is called surgical shock; that is to say, the shock or blow to the nervous system which ensues immediately upon the operation. *Cæteris paribus* the danger of shock is proportionate to the extent of the operation, that is to say, to the extent of living surface that is affected by the operation. To this rule, however, there are many exceptions. Some parts of the body when operated upon are more susceptible than others, so that operations performed on such parts are attended with more risk than operations, on other parts, involving more interference. Thus operations on the joints, like the knee-joint, are sometimes attended with extreme shock. Again, constitutional peculiarity modifies shock. Some persons of sanguine, others of lymphatic or easy temperament, pass through great operations without seeming to be affected at all, while others of nervous and bilious temperament succumb from comparatively minor operations. As a rule, the young bear the shock better than the old, but the young themselves present exceptional differences. Children who are, what is called, chubby and fat are much more likely to die from surgical operations than wiry and muscular children.

Lastly, climatic influences modify shock, the tendency to which is certainly increased by cold damp weather, in which there is a steady decline or fall of the barometer

The symptoms of shock are those generally of collapse, ending, under extreme conditions, in fatal collapse. When the mischief is less extreme there is recovery, but usually with reaction attended with severe fever and the accompanying dangers of the febrile state.

Hemorrhage.—Hemorrhage, or loss of blood, is a second accident of disease incident to surgical procedure. Hemorrhage may be primary or secondary; that is to say, it may occur during the operation, primary, or after it, secondary. Occurring in the first of these instances, it causes, on exceedingly rare occasions, sudden death from syncope. Occurring in the second of these instances, it is a source of great anxiety to the surgeon, is sometimes immediately fatal, and is almost always checked with more difficulty than when it is of primary origin. In checking it, it may be necessary to re-open a closed wound, when it gives rise, usually, to extra trouble and danger beyond the mere matter of loss of blood, the progress of the healing of the wound being much interfered with and retarded.

Surgical fever.—Surgical fever, called sometimes pyæmia, sometimes suppurative fever, is another affection following upon surgical operation, and when assuming the epidemic form, as it is wont to do in badly constructed hospitals, is a source of the severest trouble to the surgeon, and a cause, often, of excessive mortality. The disease runs a rapid course, the period of its incubation or setting in being short, and indeed limited frequently to a few hours' duration; while the whole course of a typical case of the worst kind running on to death may be included in two or three days. There is high fever in these cases, tendency to rapid decomposition in the wound, formation of pus with distribution of purulent elements over the body by the blood, and very often collapse from separation of fibrine on the right side of the heart and arrest of the circulation from that cause. When the primary symptoms of surgical fever are over, the danger of secondary symptoms is still imminent. The distribution of purulent elements, by which secondary abscesses are produced in the lungs or other organs of the body, may cause accompanying irritation and inflammation, or acute rheumatic affection.

Erysipelas.—The inflammatory and contagious disease called erysipelas, which has been described at p. 55, is another of the complications apt to be a sequence of surgical operation, and is sometimes of fatal significance. In badly constructed hospitals or wards erysipelas breaks out occasionally in the spreading or epidemic form, the patients being attacked in the parts of the body which have been subjected to operation, or it may be other parts, such as the side of the face or head.

Cachexia.—The condition of disease described at p. 41 as cachexia, or chronic state of exhaustion and feebleness, leading to gradual extinction of vital power, may, in bad constitutions, be the finale of a serious surgical operation, or even of an operation not itself considered of importance.

Lastly, the spasmodic disease called *tetanus*, vulgarly lock-jaw, and some other rare nervous affections, may follow, in the same way as from accident, the efforts of surgical art to prolong life.

General Anæsthesia in Relation to Disease and Mortality.

Since the beneficent art of anæsthesia for removal of sensibility in surgical operations has been reintroduced into medicine,

certain diseases and fatal accidents have no doubt also been introduced. But the evil caused in this manner has been comparatively trifling compared with the advantages and freedom from suffering that have been attained. It is now thirty-seven years since the discovery was made, in America, that persons about to be submitted to surgical operation could be put to sleep by the vapor of sulphuric ether, and be made to remain unconscious to suffering during a period of the longest surgical procedure. Since then hundreds of thousands of persons have been rendered insensible by means of ether or of some other anæsthetic, and I do not think it would be possible to show that so few as one thousand fatal accidents have occurred to mar the splendor of the discovery. I have been an attentive observer during the whole of the period of anæsthesia and a special investigator of the process, and am therefore justified in expressing a conviction that by comparison of the good and the evil, no discovery could have been more serviceable to mankind than that of anæsthesia. At the same time I would not attempt to conceal certain disadvantages connected with it, and which I now proceed to mention.

The first anæsthetic introduced was really nitrous oxide gas, commonly called laughing-gas, but that was soon superseded by an agent suggested from it, namely, sulphuric ether, or more correctly, ethylic ether. After a while a substance called chloric ether took the place of sulphuric. Chloric ether was a mixture of a chemical substance called chloroform, and this, in turn, led to the application of chloroform pure and simple. Chloroform, after being introduced, retained its place for many years, but as its administration was attended by a considerable number of fatal results, research was instituted to obtain an equally convenient, and at the same time safer, agent. By such research I was led to introduce the bichloride of methylene, commonly called methylene, as an anæsthetic. By such research other experimentalists were led to recur to nitrous oxide in the pure form, for short operations, as for the extraction of teeth, and to introduce other anæsthetics.

There have been four anæsthetics in use for general anæsthesia, which remain still in use. Their relative values may be fairly placed as follows. For short operations there is *nitrous oxide*, which is extremely effective and has led to a very small mortality, the smallest of any agent of its class. It is, however,

not absolutely free from danger; it has led to certain symptoms of disease which are described at page 355, and it has a few times destroyed life.

Next in regard to safety stands *sulphuric ether.* This agent, which in action very much resembles nitrous oxide, has been a cause of a limited number of deaths. It sometimes produces the symptoms of disease referred to at page 354.

Next to sulphuric ether in regard to safety comes *methylene bichloride*, a substance which for rapidity of action as well as for steadiness of action resembles chloroform, and indeed is more expeditious in its effects. There have been several deaths under methylene; but a few of these ought to be deducted, owing to the circumstance that chloroform instead of methylene was actually the agent employed, the methylene not having been properly prepared.

Chloroform of all these agents is that which has proved most fatal. As I have stated at page 354, the fatality produced by it may be estimated at about 1 in 2,500 administrations. Chloroform produces during administration four degrees or stages. In the first stage consciousness is not lost, but there is often great resistance and a desire for pure air. In the second stage consciousness is lost, but the operation cannot be performed because the patient is restless, often convulsed and even rigid, or screaming, or affected with vomiting. In the third stage, that of complete unconsciousness, the surgeon carries out his duties without the infliction of any pain. In the fourth stage there is extreme unconsciousness, with complete relaxation of all the muscles of the body. This stage is only induced when it is necessary to overcome every degree of muscular resistance.

It is in the second of these stages that the largest mortality from chloroform occurs. I am of opinion that at least fifty per cent. of the deaths happen during the second stage, while about thirty to thirty-three take place in the third and fourth stages. A small number, reaching perhaps five to six per cent., happen during the first stage, even after one or two inhalations, and are probably due to fear, being the equivalents of the deaths from fear, prior to operation, which were recognized in the days before anæsthesia was introduced. A remainder of from eight to ten per cent. of deaths from chloroform takes place during recovery from chloroform, or as the result of the shock of the operation combined with anæsthesia.

The other anæsthetics named induce similar stages, and deaths from them occur in much the same relationship in so far as stage is concerned.

It is an exceedingly difficult matter to account, in many instances, for death under anæsthetics. There seems to exist at all times in the population a certain number of persons who are, if I may so express it, predisposed to succumb under the influence of narcotic vapor. In certain of these the reason of the tendency is clear enough after death, for they are found to have fatty degeneration of the heart, of the brain, of the kidney, or some degeneration of the blood-vessels. But in other instances no such changes as these are discoverable, and although the physician is sometimes able to say in respect to some who are about to undergo operation, that general anæsthesia is imprudent or unsafe, there is a greater number in whom it is unsafe, although they present no reliable grounds for such prediction.

Speaking generally, persons who are hard drinkers; persons who are suffering from decided indications of fatty degeneration of the heart; persons who have signs of obstructed circulation, such as large and varicose veins, or dropsical swellings of the feet; persons who have had apoplectic threatenings or seizures; persons who have evident symptoms of Bright's disease of kidney; persons who have intermittency of the pulse; and persons who are exceedingly emotional and nervous, are bad subjects for general anæsthesia.

A great many more anæsthetics than those I have named have been employed for short periods and in what may be called an experimental way, and various admixtures of anæsthetics, such as ether and chloroform, ether and methylene, ether chloroform and alcohol, have been similarly used. But, the general tendency of practice is towards demand for a single anæsthetic which shall act without variability.

A perfectly safe and convenient general anæsthetic remains still to be discovered.

BOOK II.

PART THE THIRD.

ACQUIRED DISEASES FROM MENTAL AGENCIES, MORAL, EMOTIONAL, AND HABITUAL.

CHAPTER I.

ACQUIRED DISEASE FROM MENTAL AGENCIES.

Amongst the induced or acquired conditions of disease, or diseases incident to human kind, are those which spring from mental influences, and which are due to something done through the mind of the affected person himself, or by some one or something outside himself. By virtue of his higher mental organization, man differs from the inferior animals in relation to the classes of disease which are now under our consideration. The difference is one which is not altogether in his favor, and which is very distinctive in respect to him. He shares with the animal world generally in regard to the influence of the animal appetites on his physical nature. He shares with many of the higher classes of animals in regard to the influences of fear, rage, jealousy, and those faculties of mind which we call the passions. But he is subjected to other influences which are exclusively his own, and which belong to his peculiar moral, intellectual, and habit-forming characteristics.

Man, consequently, derives, through mental agencies, a number of diseases, physical and mental, which cannot strictly be said to belong at all to the lower forms of animal life. More than this, in respect to some of the very influences which affect them equally with him, under certain circumstances, he has what they have not, a special gift of foreknowledge, which causes him to be affected by the anticipation of what is to happen, or what may happen, and which anticipation may be to him as severe as the actual occurrence of what is expected.

We have then, in dealing with man, to consider a number of induced symptoms or diseases which, brought about purely by mental influences, are also brought about by such subtle influences that it is very difficult to trace the effects up to their cause. The difficulty is rendered greater by the circumstance that physical

conditions of an unfavorable kind often combine with the mental to aggravate the result, or sometimes precede and lay, as it were, the foundations for the evils which are lighted up by mental shock or mental disturbance. In other words, the person affected with some physical disability, following it may be upon some preceding disease or diseased condition which seems to have been recovered from, is disposed to recurrence of the physical malady under the action of depressing or exhausting strains which tell upon the body through the mind.

I pointed out this fact many years ago in my work entitled, "Discourses on Practical Physic." I showed there that the class of cases where nervous shock or strain excites latent or intensified actual symptoms, includes many varieties of disease, such as psoriasis and other chronic eruptions on the skin, cancer, epilepsy, and insanity. In such cases I argued there is some preceding condition, hereditary or acquired, which by causing primary injury to the nervous structures leads to a chronic exhaustion that is easily intensified by the slightest mental shock. Thus cancer frequently shows the first signs of its presence upon the occurrence of some great mental anxiety. Thus eruptions on the skin will follow from exposure to excessive mental exertion. Thus insanity, which probably is never the result of simple mental overstrain, but is marked by mental inactivity as its forerunner, becomes pronounced when some mental shock or strain calls it forth.

Within these last months Dr. Crothers, who has the superintendence of a home for inebriates in the United States, has illustrated this same point with great effect in respect to what he calls the influence of psychical traumatism, or, in other words, mental wound, on persons who have become total abstainers from alcoholic drinks. Dr. Crothers explains that such persons may be perfectly safe under the protection of total abstinence so long as they are free from the danger of mental depression or blow; but when they come under such source of depression, so intense is its effect upon them, that, losing all moral control, they fall back upon alcoholic stimulants, and, plunging into inebriety, become its hopeless victims, incurable by any measure short of forcible and entire deprivation from alcohol.

In brief, all states of impaired nervous system, whether they be hereditary in their nature or acquired by the accident of

physical disease, assist materially in the development of further physical disease from mental shock or strain. It may be that in every case of mental shock there is some such predisposing tendency, inasmuch as no living being exists, up to the present time, who can be declared free of all physical defect, latent or active.

It is remarkable how very little the question of the origin of physical diseases from mental shock or influence has been studied. Even physicians have let this question largely stand aside, as if content with the contemplation of the grosser and more material evidences of the origins of disease. To consider how a person should be injured by taking some deleterious substance into his system through his breath, his stomach, his skin, his blood, were a truly scientific and rational pursuit; but to consider what shall enter by the senses or windows of the mind, and so invisibly entering be potent for evil or for good, that were too refined and indefinite a pursuit. To observe that a person fainted from loss of blood was naturally to inquire into the reasons of the phenomenon, and, step by step, to trace it out in all its mechanical and physical meanings. To observe, however, that a person fainted on receiving some disastrous news was not suggestive of inquiry, because the phenomenon was due to something which seemed not to admit of inquiry, but to define that which was inexplicable and inevitable. At the same time, the characters of the resultant phenomena were seen to be much the same, and, as it were, to have some common origin.

I propose in the next few chapters included in the present part of this work to treat briefly on the connection of mental agency with the production of physical disease, and I undertake the task under the solemn conviction that the need for the study was never so decided as at the present hour, because the need for it increases with the intellectual development of the race. An uncultivated all but animal human race, possessing the appetites as its leading characteristic, and having few other qualities higher than emotions resting on the appetites, may be so near to the animal world that little more than the physical agencies which affect it call for observation. In a higher development and civilization the positions of mind and body are modified. Impressions telling upon the body through the mind become more potent, rapid, and persistent. The mind begins to rule. Upon this the body, now more subservient to the mind, grows upmore susceptible to men-

tal influences, and the diseases developed in it partaking of its susceptibilities are brought out more decidedly through its impressionability.

I am quite sure that within the range of my own personal observation as an investigator of disease, that is to say, within the range of thirty-five years, I have seen a marked difference in what I may call the individuality of disease, as a result of progressive intellectual life. I am sure that what we used to call the strong physical or sthenic forms of disease, are less in number and less intense in character than they were some years ago. I am equally sure that modified, if not new, forms of physical disease, developed through the mind, are much more common than they were, and that in many respects disease generally is assuming a new phase, typical of the national life in its present stage of transition.

In making this statement on the natural history of disease I am offering nothing that ought to be considered alarming in its nature. As a whole, disease, in its grosser forms, is being reduced, mortality is lessening, and life is becoming of longer duration. These are cheering facts, and are facts indicating that the perfection of health and life is compatible, as it is perhaps only attainable, by the perfection of civilization. I therefore allude to the change with hope as the password.

In addition, I have no idea of any evil arising from mental work when that is carried on with evenness, order, and generalization. The brain is the most enduring of organs. It is the organ that admits of most change; it is the organ that requires most change; it is the organ that is the most perfect repository of animal force, and is the most ready dispenser of it; it is the organ that can rest in jaded parts and work in parts that are not jaded at one and the same time. So brain work, which means mental work, may be hard work without being dangerous, may be conducive to health of life and length of days; and, by development of the nervous organisms, during generation upon generation, may give to mankind an increase in health and the possession of a longer natural life; may indeed, by continuous evolution, lead to an unthought of birth of human existence.

This for the possible future. For the moment I must ask attention to physical disease from mental shock or strain; to disease springing immediately if not absolutely from something

which takes place through the agency of the mind. We may follow up this study in three directions.

1.—In relation to those influences which we call moral, which are usually imitative, and which are contractable by imitation.

2.—In relation to those influences which spring out of the passions or emotions, and which are either the quick responses or reflexes of some external action passing through the mind, instantly, from without; or, which, coming originally from without, have been laid up or stored in the mental recesses.

3.—In relation to those influences which depend on repetitions of mental directions, tendencies, or feelings, and which by repetition become second natures, habits, or habitudes.

CHAPTER II.

ACQUIRED DISEASE FROM MORAL AGENCIES.

The class of affections which admit of being considered as arising purely from moral agencies are either directly imitative in respect to origin, or hereditary, or a combination of imitation and hereditary proclivity. Probably in a great majority of instances the hereditary proclivity is the basis, while the imitative action, by which the phenomena of disease are rendered manifest and often permanent, is only called forth because the tendency or aptitude towards the imitation is strongly developed. Imitation of phenomena of disease is not indeed materially different, except in results, from that power of imitation which makes some persons excel in the various arts and exercises of skill in which it is commonly said they are born to excel.

To a certain extent every person is imitative, and many of the commonest acts of life are the results of imitation. No two persons live together for many years without assuming some characteristics common to both, the weaker acquiring, as a rule, the characteristics of the stronger. Features themselves are modified by imitation, and so it is a matter of every-day observation that married couples become so much alike that they might be mistaken for brother and sister, in which observation we detect how intimately the hereditary and the acquired faculties of our nature blend the one with the other.

It is not surprising then that persons of feeble, nervous organization should come, incidentally, under the spell of imitation in relation to disease, and that we should have presented to us in nature, amongst the representatives of human kind, a series of diseases depending for their development on moral agencies.

Esquirol, who seems to have been amongst the first to recognize clearly and to define these diseased conditions or diseases, treats of them as diseases of sympathy, while the learned Prosper

Despine of Marseilles of our day, treats of them as due to moral contagion.

In many points of view the hypothesis of contagion, taking the word in its general sense, is not only correct but exceedingly expressive. The diseases induced by moral contagion are analogous to some extent to those which are traceable to physical contagion. Sometimes they take a spreading or epidemic character, after the manner of the ordinary spreading or contagious affections more commonly known as catching affections or pestilences, in which case they may widen into great epidemic outbreaks. Sometimes they assume what is called a sporadic form, that is to say, they are confined to a limited number of persons living in a limited district. Sometimes they take what is called the idiopathic form, that is to say, they appear only in particular individuals.

When the diseases dependent on moral influences have assumed their widest extension, it has been observed that, like the commoner epidemics, they have exhibited their periods of origin, intensity, and decline. The analogies go further. A common contagious disease is often traceable to an imported case, or to what may have been designated, a case of spontaneous origin. In the moral epidemics the same modes of development are discoverable. During a common epidemic one prevailing disease may seem dominant. The like has been observed during moral epidemics. In common epidemics all persons are not equally susceptible to the influence of the contagion ; some are extremely susceptible, others are insusceptible. The same obtains in relation to the diseases of moral origin, whether they are of epidemic, sporadic, or idiopathic character.

Again, physical contagious diseases, such diseases as smallpox, scarlet fever, and the like, present their greatest activities at particular seasons of the year, and that with such regularity as to enable the periods of intensity of these diseases to be marked out and classified. Something similar has been observed in respect to the diseases of moral origin. Thus the Rev. W. Archibald, in a description of a peculiar imitative convulsive disease of moral type, which appeared in the Shetland Islands, showed that the affection was only presented during the season of summer.

It occasionally happens during times when an ordinary contagious disease is present that the disease, say it be cholera,

appears to excite a similar form of disease, simply by the moral influence which it exercises. Under these circumstances physicians themselves may be placed in the greatest difficulty in determining whether a suffering person is affected by the actual malady, or only by a moral or simulated attack; the chief point of diagnosis being that the simulated disease is usually of shorter duration, and rarely fatal. Here the mental and physical conditions blend.

The analogy between the physical and the moral diseases is further supported by the circumstances that a moral epidemic sometimes succeeds, and, as it were, supersedes a physical. This fact is so marked that it forms, as we shall see, a conspicuous feature in the histories of some great physical and moral epidemics. Lastly, both classes of disease, moral and physical, are most readily suppressed by the plan of separating the diseased from the healthy.

The analogies above presented are sufficiently striking, but it is fair to indicate that there are also differences between the two classes of phenomena. In the first place, moral contagion appears generally to be easily detectable, the time when the imitation took place and all else that relates to the mode of transmission being recognized or recognizable. Physical contagion, on the other hand, though it may be essentially physical and material in its nature, may neither be detectable nor definable by present facilities of observation. In the second place, the diseases of moral origin are not independent in character, they are truly simulated, or simulative affections assuming the form of some other well-known disease which is, or may be considered, of purely physical character. This fact will be brought out by the history of certain of the moral or imitative diseases which have to be described.

Classes of Disease from Moral Agencies.

Diseases developed through the nervous system are those most distinctly brought out through the agency of moral causes. The effect of shock from mental disturbance is one amongst the most marked of the diseased conditions so induced. A mental shock from bad news suddenly communicated, from intense grief, from intense disappointment, and in very sensitive natures from

some sight or sound, and specially from sound, is all-sufficient to create an effect in the nervous system so similar to that which is produced by common physical accidents as to be indistinguishable by effect. Thus in ordinary conversation we are wont to speak of persons being stunned by the news they have heard; or of persons being rendered bloodless and faint on receipt of overwhelming intelligence; or, of persons being palsied by the effect of some painful or alarming impression that has been made upon them through the mind.

Thus we have at once three physical phenomena of disease through the nervous system presented to observation as possibly due to mental agency, and these diseases of major import; concussion, syncope, palsy. The list does not end here, for it sometimes happens that diseases of a chronic kind are indirectly produced from a mental blow, of which diseases diabetes sometimes offers a striking example.

Again, the subtle train of physical diseases through mental agencies may be induced, without any shock, through mere matter of imitation, the affected person, predisposed, perchance, to the affection afterwards developed, showing the first signs of the malady on being simply in personal contact with some one suffering from the affection. In these cases the form of disease indicated is commonly a muscular excitement brought out by the nervous disturbance, and is for a long time continuous if not permanent.

Once more, in certain unhealthy conditions of the body, where the arterial tone is feeble and the balance between the heart and its recoil is uncertain, and where, also, accompanying this state or leading up to it the nervous ether is deranged or modified, very slight external physical causes, causes which are not felt by healthy persons, are sufficient to set up in susceptible persons one or other of a long series of symptoms, which may simulate any of the true physical diseases.

In these instances the causes at work may act through any of the senses—the smell, the taste, the touch, the seeing, the hearing. We say, there is exalted sensibility in the persons affected. The definition is quite correct. We say, for want of a better term, that the persons affected are hysterical or hysterically disposed. It would be more correct to say that they are for the time living under a different constitution or state of body from that

which is natural. They are, in a word, in a special state of nervous tension, so that every vibration in themselves, so that every vibration outside themselves, whether arising from motion of parts of the body, or from mental fluctuations, or from variations in external temperature, or other external causes, may be sufficient to develop temporary phenomena of disease, exhibited through the nervous and muscular systems.

It not unfrequently happens that in the persons of this hysterical nature, the causes which lead to concussion, syncope, and paralysis come into play with unusual effect; so that the hysterical are specially predisposed to be stunned, to be rendered faint, to be paralyzed, by influences which do not affect their stronger and less susceptible companions. They are, too, more easily affected by the observation of peculiar or distressing actions, and are thereby rendered more liable to diseases induced by imitation.

CHAPTER III.

ACQUIRED DISEASE FROM MENTAL SHOCK.

The effects of mental shock telling upon the different organs of the body through the nervous organization lead sometimes, as I have hinted above, to direct concussion or stun. The stun may extend to what is called stroke or apoplexy, and is one of the fatal forms of apoplexy in some instances where it happens to those who, by pre-existing organic disease, have become disposed to apoplectic seizure. In the majority of instances it is nothing more than a temporary shock or blow, from which, after a time, recovery takes place and all is well. In other instances, recovery from any immediate danger is secured, but the shock which has been given conveys a sufficient impression to derange, more or less permanently, the mental and physical life. A man or a woman under these circumstances is said to have broken down, or to have lost self-control, or energy, or heart. These terms, which are as expressive as they are true, have been used from the first days of literary art in the works descriptive of the history of man, his mental attributes, his failures in attempted successes, and his successes themselves.

Inebriety from Mental Shock.

Persons breaking down, as here described, show the failure in various ways. Some, losing moral control over themselves, resort to artificial methods for sustainment, flying generally to such agents as alcohol for support. These form the class whom Dr. Crothers defines as dipsomaniacs from mental wound.

One man, says this author, in a communication which he has been so good as to send me, "one man gives a history of over-work under conditions of great mental excitement, from which he has never recovered his former vigor. Years after he becomes

an inebriate, but he never traces the connection between the former overwork and the inebriety. A careful inquiry will show many hints along this interval,—which may be years,—that refer directly to this event, showing that inebriety is but the result of degenerations which began there. In another case, a man suffers from some profound grief and sorrow, which at the time breaks up his health, and for a long time after is felt in general debility and weakness. Years go by, and suddenly he drinks to intoxication, and is an inebriate at once. No good reason can be given for drinking, and possibly no stage of moderate use of spirits precedes the inebriety. To himself and friends a degree of ill-health has been recognized from the time of his great grief, and to the physician who can study closely this interval, there will be found nutrient perversions, neuralgias, eccentricities, and nameless indications of a coming storm.

"A very large class of cases has in the past suffered from some form of disease, from which the sufferers have recovered with an entailment of debility, and a want of something that cannot be defined. They are fully conscious of diminished power, of change of vigor and force. It may be they do not sleep naturally, and do not get the usual rest; or they do not recover quickly when exhausted, cannot digest food thoroughly, have dyspepsia from slight causes. They are more sensitive than before, emotional and excitable with every event that is irritating.

"In one case a man has a severe pneumonia, with a tedious long convalescence. After recovery a change of disposition and character is noticed, and a year or so later he begins to drink spirits, and soon becomes an inebriate. In another case, a man recovers from typhoid fever, and for a long time exhibits some marked alterations of habits and character, then suddenly or gradually he becomes an inebriate. There can be no doubt that inebriety originated in the traumatism, or wound, following the diseases in these cases. Some special exciting cause favored its development, or possibly the injury done to the nerve centres would only manifest itself in this way. The first causes are traumatic, following the diseases or lesions which take place, particularly notable in the complex range of psychical symptoms that are seen. The integrity of the organism and function has been impaired, and from this point disease and diseased tendencies are developed.

"These cases are found in every community. Of course the affected do not all become inebriates, but, like a large class of eccentrics, they are on the border line, or inner circle shading into inebriety or insanity. A large number of persons engaged in the late civil war, who suffered hardship and mal-nutrition, became inebriates, years after, following the psychical and physical traumatism received at that time. The effects of commercial disasters, of bankruptcies, and panics in Wall Street, can be seen in inebriate or insane asylums. In the asylum for inebriates, at Binghamton, New York, at one time were eighteen cases whose inebriety could be clearly traced to a great money panic in Wall Street known as the 'Black Friday.' Many of these cases were purely from psychical traumatism, others were already in the dark circle close to inebriety, and needed but a slight cause to precipitate them over. Political failures are also fertile fields for the growth of inebriety, and the action of psychical influences. Annually a large class after the close of a campaign find themselves literally inebriates, and if they have money go to water cures, inebriate asylums, or to the far West and begin life again. The inebriety is often of the paroxysmal or dipsomaniacal type, with free intervals of sobriety, that give renewed energy to the delusive hope that recovery will follow the bidding of the will.

"Classes of moderate or occasional drinkers are always more susceptible to these influences than abstainers. This was marked in an instance where three men, two moderate drinkers and one abstainer, partners in business, with equal capital, lost their all in one night. The abstainer recovered and resumed again; the moderate drinkers both drank to excess after, and died inebriates. It may be stated, as a rule, that moderate drinkers suffer more frequently from psychical shocks of every form, and are more likely to become inebriates from such causes. The inebriety that follows directly or indirectly from psychical traumatism, differs in natural progress and history from other cases. The physical degenerations are more pronounced, the heart and liver take on organic disease quickly, and the mental symptoms are prominent. In some cases the course of the disease is paroxysmal, and the mental degenerations are suspicious of what is called moral insanity."

Exhaustion from Mental Shock.

In the feeble mental shock, both in the acute and in the after stages of its action, tells, through the nervous system, upon the heart. At first it leads to faintness, which may be complete, and which, in rare instances, is complete to fatality. Short of this extreme event, the faintness, when it has passed away, may recur, or, not recurring of itself, may leave a weakness which tends to produce a repetition of the phenomenon on repetition of severe or even of slight shock. Often the first effect produced, though it may not recur with the same intensity, is followed by a derangement in the action of the heart which lasts, probably, throughout life, and which is a source of persistent embarrassment and enfeeblement. That peculiar condition of the circulation described on pages 138–9, under the head of intermittent action of the heart, is, of all others, the deranged condition most closely connected with mental shock.

In another class of persons the mental shock tells first through the brain, it may be, in the form of stun, or in the form of faintness or syncope. It is then followed quickly, and as if in continuation of the original blow, by local failure of power in some one limb or through the whole of the half of the body. The physical diseases thus implanted are the same as those which have been described at pages 176–77 under the head of paralysis, palsy, stroke.

In other instances persons deeply stricken with mental exhaustion, fall into despondency, lose all taste for life, and, seizing a moment of courage for the desperate act, put themselves out of life with their own hands. These form the class called by Despine, "suicides determinés par le désespoir."

Diabetes.

Mental blow or shock is further capable of inducing chronic changes in the nervous system, leading to the development of at least one special disease, namely, diabetes, the definition of which is given at page 65. I notice diabetes as originating from mental shock once more because it affords so remarkable an illustration. The disease is one which is ordinarily known as being attended with a profuse discharge of renal secretion, such dis-

charge constituting, in fact, the marked demonstration of the disease. For ages past it has been known that mental disturbances determinately influence this secretion, rendering it sometimes copious and pale, and at other times causing it to be charged with deposits of pale pinkish color. Now we know that diabetes, in which a large amount of grape-sugar is imported into the secretion, may be induced by mental as well as physical shocks affecting, primarily, the brain. The production of the disease through the mental shock may be actually startling, as in the following instance, which came under my own cognizance. A healthy boy, eleven years of age, was sent by his father, a carpenter by trade, to a wood-yard, to give an order for some timber. In the yard there was chained up a large and savage dog. The child, not aware of this, passed down the yard, and before seeing danger was suddenly set on by the furious animal. He got out of reach of the chained brute, but was so paralyzed by fear he could not for some seconds stir away. He now became faint, was carried home in a state of extreme prostration, and from that hour was stricken of diabetes, from which malady, in three months, he died.

Diabetes is an affection which can be artificially or synthetically produced by physical injuries of the cerebral organ. I have shown that it may even be caused, temporarily, by a disturbance in the circulation of the brain, and that men engaged in the art of coloring a ceiling produce, by the act of holding back the head for a long time, a derangement of the cerebral circulation sufficient, in some cases, to lead to the affection during the time they are at work.

The effect of mental shock, in causing diabetes, will possibly lead to other systemic diseases being traced to a similar cause, and to the connections that exist between physical and psychical influences affecting mankind.

CHAPTER IV.

ACQUIRED DISEASE FROM IMITATION OR MORAL CONTAGION.

At various periods in the history of the world there have been presented diseases of the most singular kind dependent upon imitation or moral contagion.

Such diseases have assumed an epidemic form, as convulsive affections bearing the various names of *Dancing mania; Tarantism; St. John's Dance; St. Vitus's Dance; Tigretier; Sympathy; Convulsionism* or *Secourism; Leaping Ague;* and, *Hysteria.* In other instances the imitative disease has taken the form of paralysis, or of some other serious physical malady such as pulmonary consumption. In a third set of cases it has taken the form of suicide.

Dancing Mania.

The motional type of the imitative diseases has been known from an early period in the history of medicine, but the grandest manifestations which have been recorded of it, in its various phases, broke out, in the fourteenth century, soon after the subsidence of the great typhus plague or Black Death. The moral effects of that plague itself had been very severe. The mental shock sustained by all nations during the prevalence of the Black Plague is, says the learned historian Hecker, without parallel, and beyond description. "Many fell victims to fear, and the most stout-hearted lost their confidence. The pious closed their accounts with the world, eternity presented itself to their view, and their only remaining desire was for a participation in the consolations of religion, because to them Death was disarmed of his sting. Repentance seized the transgressor, and an awful sense of contrition seized Christians of every community." But this zeal afterwards took another turn, I may say, many turns, and in

1374 there commenced in Germany the astounding epidemic of St. John's Dance, called sometimes the dancing mania of Germany and the Netherlands. In this year, the same historian, Hecker, tells us, there appeared at Aix-la-Chapelle assemblages of men and women who had come out of Germany, and who, united by one common delusion, exhibited the following strange spectacle. "They formed circles hand in hand, and appearing to have lost all control over their senses, continued dancing, regardless of the by-standers, for hours together in wild delirium, until at length they fell to the ground in a state of exhaustion. They then complained of extreme oppression, and groaned as if in the agonies of death, until they were swathed in cloths bound tightly round their waists, upon which they again recovered, and remained free from complaint until the next attack." The swathing was resorted to on account of the tympany or distention of the body, which followed the spasmodic ravings; but sometimes the by-standers relieved the patients in a ruder manner, namely, by trampling on the affected parts. "While dancing, the dancers neither saw nor heard, being insensible to external impressions, but were haunted by visions. When the disease was completely developed, the attack commenced with epileptic convulsions. Those affected fell to the ground senseless, panting, laboring for breath. They foamed at the mouth, and suddenly springing up, began their dance with strange contortions."

The disease, appearing at Aix-la-Chapelle in July, 1374, extended through the Netherlands, and through Belgium, to Cologne, where more than five hundred were attacked; and to Metz, where eleven hundred suffered.

It is supposed that as the first dancers in Aix-la-Chapelle appeared in July, with St. John's name in their mouths, that the wild revels of St. John's day gave rise to the plague.

About forty-four years later another dancing plague, called St. Vitus's dance, broke out at Strasburg, and extended largely. The sufferers in this case were conducted to the Chapels of St. Vitus, near Zabern and Rotestein, where, by the ministrations of the priests, they were said to be cured. The minds of the sufferers, according to Hecker, were probably soothed by the narration of a legend respecting St. Vitus, that before his death by the headsman, in the reign of Diocletian, he prayed that he might protect from the dancing mania all who should solemnize the day

of his commemoration, and fast upon the eve of it, and that a voice from heaven was heard saying, "Vitus, thy prayer is accepted."

Tarantism.

Later on, towards the close of the fifteenth century, there broke out in Italy a motional disease, which took the peculiar name of Tarantism, because it was believed to be caused by the bite of the *Tarantula,* a ground spider common in Apulia. Perotti, who describes this plague, states that those who were bitten,—I am quoting Perotti, from Hecker,—generally fell into a state of melancholy, and appeared to be stupefied, and scarcely in possession of their senses. The condition was in many cases united with a great sensibility to music, under which they sprang up, shouted, and danced until they sank on the ground exhausted and almost lifeless. Others, on the contrary, wept and pined in the greatest misery and anxiety. Others died in a paroxysm of laughing or weeping. In time tarantism spread, and was attended with more extraordinary phenomena, some of the sufferers taking the most vehement dislike to colors; others an ardent longing for the sea. In time the sight of sufferers who were supposed to have been bitten produced tarantism. Old men of ninety threw aside their crutches, and at the sound of the music joined in the most extravagant dances. Even the deaf, it is said, did not escape. All drank profusely of wine, and took little food. Loss of voice, occasional blindness, sleeplessness, vertigo, complete insanity, and frequent weeping without any ostensible cause, were, remarks Hecker, the usual symptoms. The disease continued until the middle of the sixteenth century.

A similar form of disease, to which the name of *Tigretier* has been given, was observed in the early part of the present century in Abyssinia, by an Englishman named Nathaniel Pearce. This mania resembled closely the dance of St. John, and took its name from Tigre, the country where it was most prevalent. Pearce noticed that the disease was more frequent amongst women than amongst men, although both sexes suffered. Hecker suggests that as in Abyssinia, where Christianity has maintained itself in its primeval simplicity, St. John is worshipped, so there may have been a connection, as to cause, between the two histories of the malady.

Sympathetic Convulsion.

Under the term *Sympathy* various kinds of disease of the motional type have been observed. In 1787 a girl working at a cotton manufactory at Hodden Bridge in Lancashire put a mouse into the bosom of another girl, who was immediately thrown into a fit, with violent convulsions which lasted for twenty-four hours. Next day three more girls were seized ; on the following day six ; on the next following day eleven. One man was also attacked who had been much fatigued with holding the girls, and three more girls were attacked at a factory five miles distant, being "infected entirely from report." The symptoms were anxiety, strangulation, and convulsions so violent as to last from a quarter of an hour to twenty-four hours, and to require several persons to prevent the patients from tearing their hair and dashing their heads against the floor and walls. By the judicious moral treatment of Dr. St. Clair the epidemic was stayed.

Something similar in the way of disease broke out in the Charity Hospital, Berlin, in 1801. And, in 1813–14, in a Methodist chapel at Redruth, four thousand people from the surrounding districts were said to have become affected with a corresponding convulsive malady. Another outbreak was recorded by Mr. Hibbert in 1822 as occurring in the Shetland Islands. The paroxysms usually prevailed during the warm months of summer and were repeated for some years, until the parish minister assured his flock that no treatment was more effectual than immersion in cold water, and that as his kirk was close to a fresh-water lake, he would have attendance at hand to insure the proper means of cure. The threat acted like a charm.

The history of the convulsionaires in France, which commenced in 1731, and under the names of Convulsionism and Secourism continued into the beginning of the present century, partook of all these forms of motional disease so closely that it would be but repetition to recount the phenomena. The same remark applies to an affection in certain parts of Scotland, called by Sir J. Sinclair *Leaping ague*, and to various outbreaks of *Chorea Sancti Viti* which have broken out in America and in this country.

Of late years no extended and definite outbreak of convulsive or motional disease has been specially recorded, but the phe-

nomena of moral contagion have not passed away. They sometimes appear, even now, on a large scale, and we meet with them occurring in what may be called the idiopathic form very frequently.

I have myself put on record two instances in which susceptible children readily acquired chorea from imitation. I have also recorded an instance in which the muscular affection called strabismus or squint was acquired by imitation.

Other Diseases from Imitation.

Pulmonary consumption. In addition to diseases of the motional type arising from moral contagion, there are others which take a less vehement but hardly less anxious character. Symptoms of consumption may thus be simulated, and I have known the history of an instance of this kind. A young woman who had been for some weeks in close communion with a patient suffering from pulmonary consumption, commenced gradually to imitate the movements of breathing and the cough of the consumptive sufferer. Gradually other symptoms were acquired, including the most perfect representation of the voice of the real patient. The paroxysms of cough increased, and the symptoms altogether seemed so real, there was, on the part of the friends of the unconsciously imitative girl, no doubt as to her ultimate fate. The stethoscope and other objective means for detection of disease yielded, however, no evidence of the actual existence of the graver malady. After two years of suffering from these symptoms she suddenly recovered.

Paralysis. In other instances the simulated disease may take the form of paralysis in susceptible subjects. A patient who was long under my care heard the details of an attack of paralysis, occurring to one of her friends, described with great minuteness. From that hour she lost, day by day, the power of her lower limbs and, later still, the voluntary command over the whole of the lower half of her body. For many weeks this condition was present, the patient remaining so helpless that she could not, even in bed, raise her lower limbs, much less move on them. The extremest and the most varied opinions prevailed amongst the medical men, who from time to time visited her, as to the precise nature of her illness. At last, during a great crisis in her family

circle, when one of the circle was expected to die, a sudden scream from an adjoining room roused her apparently dead members into life. She rose from her bed unassisted, walked rapidly into the room where the other patient was lying, and from that moment recovered the entire use of the previously, and as they seemed, hopelessly, palsied limbs. The new mental condition that was aroused constituted the cure.

Persistent muscular contraction. Persistent contraction of muscle or of a series of muscles is another disease which may affect the body through imitation, an instance of which is well illustrated in the following history. A young girl, who was living in India, witnessed some native feats and shows at a religious festival. Amongst other sights that she saw was that of a native, whose lower limbs were drawn up to his body and were there permanently fixed. The girl was morbidly impressed by this sight, and next morning was found in bed unable to rise, because one of her own lower limbs was drawn up closely and rigidly to her body. This imitative condition remained for many months, and neither by persuasion nor by force could the patient be got to straighten out the limb. She was submitted to the action of chloroform, and when her volitional power was entirely overcome by the influence of the narcotic vapor and the whole of the muscles were rendered flaccid, the contracted limb could be brought down. But so soon as the narcotic effect passed away, so soon as the will regained its dominion, so soon as the muscles regained their stimulus, so soon was the limb drawn again into its distorted and rigid position.

The young lady, with the limb in this contracted state, was brought, ultimately, to England, where she remained for many weeks without change. One day, while her attention was entirely absorbed in a game of chess, her leg was gently straightened without the slightest opposition on her part; and the moment she was conscious of the fact she undertook to walk upstairs. To the wonder of all her friends she accomplished the feat without demur or difficulty, and from that time onwards has remained unaffected. Interrogated afterwards as to the reason why her limb was distorted in the manner described, she expressed her entire inability to assign any reason. She was of opinion that although she never willed the contraction, nor by any act of will maintained the resistance, yet that the idea of it was never off

her mind, during her waking hours, until the moment when she was devoted to the simple object of winning the game of chess. Then it seemed to her that, in the excitement, she had altogether forgotten the contraction, as well as the varied forcible attempts that had been made to overcome it, every one of which, she was convinced, served only to aggravate the evil. When she discovered that the limb had been brought down the fact afforded her no surprise.

Suicide.

Suicide now and then appears as a phenomenon of disease from imitation. This fact has been specially dwelt upon by Despine, who has recorded many instances in which persons under the influence of imitation have performed the suicidal act in one particular way. For example. A soldier during the first Empire hanged himself in his sentry box. Almost immediately afterwards a number of other soldiers did the same, the contagion remaining until the sentry boxes in the garrison were all destroyed, after which there was no repetition. The iron cage on the Monument in the City of London and on the Duke of York's Column are evidences of the same imitative contagion in this country, the cages having been erected in order to prevent the frequent recurrence of suicide by leaping from the summits of the columns to the earth beneath.

It will be inferred that the act of suicide under contagious influence is only carried out by persons whose minds are previously disturbed or deranged, and the inference is practically correct. The persons were, no doubt, prepared mentally for suicide, or, as we should say in relation to an ordinary infectious malady, they were in a state rendering them susceptible to the commission of suicide. This fact does not, however, change the imitative aspect of the question, since the morbid susceptibility became evoked by the impulse of imitation and led to the practical result of suicide.

It has been assumed by some that homicide as well as suicide takes, occasionally, the imitative contagious character, but I have been unable to discover any sufficient number of facts to justify the acceptance of this hypothesis.

CHAPTER V.

ACQUIRED DISEASE FROM HYSTERICAL EMOTION.

In the earlier part of this volume, pages 87–89, we traced out how the arterial blood supply to all parts of the body is under the influence of the sympathetic nervous system, and how readily an impression made through the senses tells through that system upon the body. We have now to consider a class of cases in which certain phenomena of disease are developed, largely, from external causes acting through this nervous organization.

In some persons the excitability of the emotional nervous system is so great, that the merest disturbance of the nervous tension produces some indications or phenomena of disease. Persons so placed are said to be hysterical, and are given to manifest a long and peculiar train of diseases.

There are other persons who, without being hysterical, are easily influenced through the senses, and are rendered liable to be even dangerously affected through what are called the emotions or passions, especially the passions of anger, fear, and grief.

In the present chapter we have briefly to consider the types or forms of phenomenal disease, called the hysterical.

Under the one term hysteria so many affections simulating diseases of the true organic type have been recognized, it were almost to go over the whole of the list again to enumerate them. Some authors, indeed, would accept many of the affections placed in the last chapter as being purely of hysterical nature and would consider them of hysterical origin. The general characteristics of the disease hysteria are given briefly on p. 181, and a very few additions here will suffice.

Hysteria is almost entirely a disorder of the female sex, although it is sometimes met with in the male. It is most frequently developed in the years of life extending from the commencement of adolescence up to thirty. Its commonest symptoms

are those of emotional excitements, evidenced in paroxysms of laughing, crying, convulsive starts and movements, and periods of faintness or insensibility. Almost all cases are attended with one or other of these symptoms, but in some examples the purely physical characters of different diseases are presented without these special characteristics of hysteria, and then the diagnosis is rendered exceedingly difficult.

Excessive sensitiveness to external impressions and to pain, *hysterical hyperæsthesia*, is a common symptom in hysteria. Thus the most striking illustrations of hysterical neuralgia, or of toothache, are seen under the condition of pregnancy. On the other hand, we may have hysterical insensibility to pain, *i. e.* to common sensation, called, technically, *hysterical anæsthesia*, affecting a part of the body, as the hand or foot, or the whole of the body.

The insensibility to pain which has been produced in some susceptible individuals by the process known as mesmerism partakes of the hysterical character. All the strange phemonena that have often been recorded as observable in hypnotic and mesmeric states I should classify under the present head.

Persons afflicted with hysterical tendencies are apt to manifest various automatic movements, which are distinguishable from mere habits by the sharpness and peculiarity of their occurrence, and by the uncompromising persistency with which the automatic act is carried out.

The illustrious Thomas Willis gives us an illustration of this automatism, amounting to a condition of disease, in the case of a youth who lived near to him. This youth was silly and foolish, yet knew, exactly, without any sign the interspaces of the hours, and as often as the space of a whole hour had elapsed, as if he had been a living clock, he would personate the right number of the hour by so many hoarse sounds, and no business or employ about any other occupation could make him omit this task. He, at the beginning, was wont to imitate aloud by making a noise at every stroke of the sounding clock; and as often as he heard the sounding of the bell of the clock he cried, one, two, three, repeating successively the several pulsations. Hence, says Willis, it happened, afterwards, "that the animal spirits, by daily imitation being accustomed to be stirred up by such a motion, according to the set spaces of time, at length were able to distinguish

the same periods of their own accord, nothing directing, as if the sliding spaces of time had been measured out by the wheels of a clock." The above is an extreme case of automatic disease, and is perhaps the most singular on record, as coming from a master who was one of the most faithful observers in the whole world of science. But phenomena approaching to it are not wanting amongst the hysterical and hypochondriacal classes of modern communities. Some so circumstanced are impelled to walk a given distance each day in order to touch some particular object, or perform some particular trivial act. Others repeat in an automatic manner a series of words, ejaculations, or sentences. Others again, especially amongst the hypochondriacal, give indications, in an automatically recurrent manner, of some particular suffering or pain, which they accompany with a special observation relating to the same, but which on inquiry may turn out to have no real meaning. A further class of the purely hysterical type suffer from automatic recurrent paroxysms of pain like neuralgia, toothache, rheumatism; or again, of paroxysms of cough, difficulty of swallowing, blushing,—erethema fugax,—or palpitation of the heart. In these the singularity of the phenomenon, whichever it may be, is that it is not traceable to any definable organic origin.

The most common rules connected with phenomena of disease are open to exception, and so in the hysterical there may be internal irritations which keep up the hysteria. In these instances a true physical is combined with an emotional affection, and the results are of a serious character. I have more than once known symptoms, commonly called hysterical, terminate fatally under these circumstances. I have known, for example, what seemed to be purely an hysterical cough continue so persistently as to produce death from exhaustion. I knew death take place once from the severity of hysterical convulsion. I knew an instance in which what seemed to be hysterical constriction of the gullet, or œsophagus, ended fatally, and in which the after-examination showed that there was no organic constriction.

Persons hysterically disposed are liable to changes in the blood, and particularly to that change which has been described at page 150, anæmia. Under this condition of blood, accompanied as it generally is with loss of vascular tone, the affected suffer from numerous physical perversions, such as flushes, chills, coldness of the extremities, perspirations, irregular actions of the

bowels, deficient tone in the stomach and intestines, with flatulency as a constant and oppressive symptom, and, often, a copious diuresis of a perfectly colorless secretion. In addition to these symptoms, they suffer, at times, from distressing and painful sensations of ringing sounds in the head, which are, in fact, arterial murmurs caused by the effect of pressure on relaxed vessels in the cranial circulation. The sound produced, when it is sudden and unexpected, is occasionally mistaken as proceeding from without, and from no obvious cause.

Together with these vascular murmurs and other signs of irregular and nervous action, intensified now and then to a brisk hysterical paroxysm, there are frequent temporary perturbations of the muscles of the body; sometimes a mere sensation or quiver, "live blood;" at other times a sharp twitch or start in the eyelids or the extremities, or in some of the involuntary muscles, or through the body altogether.

The capriciousness of hysterical persons in relation to taste and appetite has often formed subject of comment by observers of disease, and is indeed one of the most peculiar characteristics of the complaint. The sense of taste may be entirely lost, or it may be so perverted that what are generally considered the most delicate flavors are disliked, while the most objectionable things are relished with avidity. In very severe examples distaste for ordinary foods passes into dislike, and therewith appetite appears altogether to fail. Instances of prolonged fasting, which I and others have recorded, are of this hysterical character, and occasionally end in death.

It will be seen from the above what a complete range over the whole field of disease is assumed under the title hysteria. It is, in short, all disease developed in an hysterical constitution and modified by it so as to present the symptoms of every disease without, except in the rare occurrences which have been referred to, presenting the danger. I might have noted many other special affections, such as somnambulism, trance, epilepsy, mania, and others which appear under the hysterical disguise; but as, in so doing, I should be repeating their phenomena, the labor is unnecessary.

One word more must be added bearing on the hysterical state in relation to what are often called supernatural manifestations and beliefs in them. The hysterically affected are of all persons

those who are impressed most strongly with the idea of the supernatural. They see, hear, feel, smell, and taste what others, less susceptible, fail to distinguish, and so are led naturally to distort trivial phenomena into startling events and appearances. They make, in simple truth, a world of their own; people it, describe it, and invent thereby a new world which, like their disease, is but a reflection of what is real.

CHAPTER VI.

ACQUIRED DISEASE FROM THE COMMON EMOTIONS OR PASSIONS.

We are self-conscious that the passions act and re-act upon our physical nature. We are aware that whatever strikes us through the emotions stirs, as it has been expressed, the blood, and produces some peculiar phenomena and vibrations, of quickened function or of arrest of function. We know that under sudden fear the face becomes pallid, the heart palpitates or trepidates, the limbs become feeble, the presence of mind is lost, and faintness or syncope is imminent or complete. We know that under lesser agitations various changes of secretion are apt to occur; that one person will suffer from acute derangement of the bowels, another from profuse diuresis, another from free perspiration. We know that under the influence of anger there are two sets of phenomena;—one in which the face is flushed and congested, another in which there is paleness or even faintness; and so we speak of a person being red with rage or white with rage. We know that under grief the most painful affections follow; loss of appetite, of sleep, of nervous power, of mental serenity.

All these are every-day facts, but the physician is aware that under the action of the various corroding passions referred to some permanent diseases are established which may kill after a short course, and which always affect the life unfavorably during its future, however far that future may be prolonged.

In the action of all the passions there is much that is common. I mean by this that they one and all strike, if I may so express myself, in the same manner, and affect the same parts. But some of the passions are more intense in their action than others. Anger, I think, is the intensest of the passions, hatred is the next, then follows fear, and after that grief. Anger is acute and short; hatred is less acute, but longer and corroding; fear is

acute and depressing, but less tense than anger; grief is more prolonged, though it may be less rapid in its onset.

Under the severe influence of any of these passions several distinct forms of disease are produced. The most obvious are those which follow.

Emotional Intermittency of the Heart.

The affection of the heart described at pp. 138–9 as intermittency, is a condition of disease which is specially induced by the influence of emotion or passion. This is so strictly the fact, that out of an unusually large observation of instances of such intermittency I have not met with one instance in which the phenomenon was not traceable to an emotional cause. In many cases the effect followed immediately upon the emotion. A member of my own profession admitted to me that an original irritability of temper was permitted by want of due control to pass almost into persistent or chronic anger, so that every trifle was a cause of unwarrantable irritation. Sometimes his anger was so vehement that all about him were alarmed for him more than for themselves. In the midst of one of these outbreaks he suddenly felt as if his "heart were lost." He reeled under the impression, felt nauseated and faint; then recovering, he put his hand to his wrist to discover an intermittent action of his heart as the cause of his faintness. He never recovered the shock, and although he lived ten years the intermittency remained, often to such an extent that he was conscious of it without tracing it out by the pulse. "I am broken-hearted," he would say, and that was the simple fact.

In another example of the same affection fear was the cause of it. A gentleman was returning home from a long voyage in perfect health, when the vessel he was in was struck by a larger one, and being hopelessly injured, began to sink. With the sensation of the sinking of the ship he felt that his heart, previously acting vehemently, stopped in its beat. He remembered no more, except a confused noise and a return to comparative quiet when he found himself on the deck of another vessel. After he had gained sufficient calmness he discovered that his heart was intermitting four or five times every minute. The intermittence continued until the end of the voyage and very much interrupted

his sleep, but on landing it somewhat decreased and became endurable. It has always remained, however, in a slight degree, with intervals of sharp intensity, under emotion, until the present day.

Grief is in like manner a cause of intermittency, and I have recorded, in illustration of this fact, the case of a woman who lost three children in one epidemic, and in whom persistent grief produced so serious an intermittent condition that her heart ceased as many as twenty-three times in a minute. As the grief subsided the intermittency also became lessened, until it was reduced to one failure in one hundred and sixty pulsations, but she has never absolutely recovered from the shock.

Reception of bad news, as of monetary failure or other source of anxiety, leads similarly, to intermittent action of the heart, not generally in an acute form, but in a permanent manner, and in such degree as to be easily intensified by additional worry or emotional excitement.

Emotional Local Syncope.

In sufferers from intermittency of the heart, another symptom connected with the irregular supply of blood is occasionally presented. This symptom consists of a sensation of coldness or numbness in the fingers of one or other hand, which sensation is followed by quick blanching of the skin, so that the skin presents the same appearance as that which is produced when the surface of the body is suddenly frozen, as by ether spray. The numbness is attended with such complete anæsthesia in the part, that an operation might, in fact, be performed painlessly at the part. The numbness and temporary death will often remain for a long period, perhaps an hour, during which time the sensibility appears to be altogether wanting. When recovery recommences it is very rapid, and the warmth and sensibility are completely restored. This local disease, to which I give the name of *local syncope*, is always, according to my observation, of emotional origin, and is also, as a rule, connected with intermittent pulse. It is due to an arrest of blood through the affected parts, probably from contraction of the minute blood-vessels there, under a nervous shock or irritation.

Emotional Palpitation.

The unnatural action of the heart, called *palpitation*, is a temporary disease often induced by emotional excitement. The condition of the heart when it palpitates is, in some respects, the same as that which happens during intermittent action, that is to say, certain of the sounds are lost with the strokes. Sometimes the second sound only is heard; sometimes the first is followed by two second sounds without a pause. The motion of the heart is also extremely rapid, so that the pulse can scarcely be counted, and when the motion of the pulse is listened to through the sphygmophone, the sound heard is almost continuous and rotary.

The emotions which most easily bring on palpitations are those of anger and fear. When anger is the excitant the palpitation is exceedingly violent, causing a sensation of choking and of fulness in the head, followed frequently by vertigo and unsteadiness, with feebleness of the limbs. When the palpitation arises from fear it is, commonly, much shorter in its duration, and terminates more quickly in faintness and exhaustion.

Epigastric or Stomach Palpitation.

There is another kind of tremulous action excited easily by the emotions, and especially by the emotions of fear and anxiety, which is called a palpitation, but which is not, really, a palpitation of the heart. Some of the old writers call this "epigastric palpitation," and the term is exceedingly appropriate. The palpitation is experienced as a fluttering or severe tremulous throbbing just above the stomach, and is attended with a sense of feebleness or sinking in the stomach, and it may be with nausea. At one time I thought this symptom, which I had often heard described by the sick, must needs be, after all, a palpitation of the heart. I was corrected in this view by an eminent man of science, who assured me, as a sufferer from the affection, that when the palpitation was in or near the stomach his heart beat and pulse beat were perfectly correct. To prove this he came to me during a paroxysm, at a time when he had unbearable palpitation. "You can see it," he said, "through my clothes, but it is distinct from an intermittent action of my heart, and from the action of my heart and pulse at the wrist, as you will find." His observation was accurate; his heart was beating seventy-four

times a minute, with intermittent action every sixth stroke; but the motion of the heart and of the pulse at the wrist was entirely distinct from the vehement, rapid pulsation in the region of the stomach. The palpitation was from some pulsating organ immediately below the heart, and had no relation to the regular motion of the heart.

To the observer epigastric palpitation is most distinctly detected a little below the lower termination of the breastbone. It consists of a series of quick throbs, very full and bounding, and attended often with a faint murmur. It is usually accompanied by a sense of fulness in the throat, and is relieved by eructation of flatus, or by passage of gas along the small intestine into the colon. It is rarely prolonged, and although painfully disagreeable, is not of itself of serious moment. It is often, but not always, associated with intermittent action of the heart.

In my first study of epigastric palpitation I thought that it was due to a tremulous movement in some of the muscular fibres of the diaphragm. But further observation showed to me that the pulsation is really vascular, and is due to motion in one of the large arteries proceeding from the aorta to supply the abdominal viscera, probably the large but short arterial trunk, called the cœliac axis, which gives off the three chief vessels for the supply of the stomach, the liver, and the spleen. It is as if the nervous supply to the vessel was rendered in an intermittent manner, and that the vessel underwent a series of rapid vibrations independently of the motion communicated to it by the heart. This symptom is often described by nervous sufferers as a "fluttering" near the stomach.

Emotional Vascular Flush.

The symptom, called by the older writers on diseases of the skin "erythema fugax," and described at p. 251, is connected closely with emotional excitement. The red blush which mantles on the cheek when the mind is influenced by praise, or blame, or shame is, practically, an erythema of a fleeting kind. But, in very emotional subjects this blush or redness, which may be excited by exceedingly trifling causes affecting the passions, is widely extended, the suffusion appearing at first, perhaps, on the neck, and then rapidly extending over the face and even over the

whole of the body. I have known a few instances in which the erythema was confined to one side of the body, appearing only on the right or left side of the cheek, neck, breast, or limb. As a rule, the affection is not of great importance, and in itself it is of no serious moment. It does, however, in rare examples, stand out as a sign of serious nervous derangement. It is of more importance when it attacks one side of the body only than when it is equally distributed over the same surfaces on both sides of the body.

Emotional Unsteadiness of the Circulation.

Unsteadiness of the circulation, without actual intermittency, is a condition of disease that is very often connected with emotional excitements. The heart in such cases is said to be irritable, and it is very readily made irregular in its beat, at one time quick, at another time slow, during, perhaps, short intervals. When the action is quick and irritable the mind is in much the same state, the body is feverish, and the muscles fidgety and restless. After this first stage passes away, and it usually passes quickly, the heart is left enfeebled, as though it had suffered an organic shock; the mind is depressed, the surface of the body is chilled, the muscles are languid, and the brain, too tired to sleep, is fretful and exhausted. In these states of body the digestion is always imperfect and the secretions irregular. The emotions which bring on these irregular functions of the heart are those chiefly of anxiety connected with anticipation. They are essentially the emotions of the speculator and the gambler, but they are sometimes also those of the political partisan and even of the religious enthusiast. I have seen them performing the part described as producers of diseased action under all these phases, and they lead not uncommonly to actual derangement of the mental equilibrium.

But of all the passions for exciting this unsteadiness of circulation hatred is the most determinate. Hatred acts much like anger in the effects it produces, except that the effects are less suddenly developed, while they are much more closely concealed. They rarely indeed come under the cognizance of the physician unmixed with other phenomena, or until distinct physical changes have resulted from them. The emotion keeps up suppressed anger with morose determination and with a restless activity of

mind which lead the sufferer to neglect the necessities of his own existence. His circulation is always disturbed, he is feverish, excitable, and, in turns, feeble. As the very accomplishment of the desires he may have afford no palliation, he at last either sinks into chronic despondency and irritability, which ends slowly in fixed melancholy, or he passes quickly into acute and helpless mental derangement, from which recovery is of rare occurrence.

Emotional general Syncope.

A blow or shock delivered through the emotions is not uncommonly followed by syncope or fainting. In a past day emotional syncope or swoon would seem to have been of much more common occurrence than in this day. The swoon which once was historical, and which seemed on the part of the fairer section of the creation to be an essential feature in every emotional scene, was not, we must suppose, extremely serious, seeing that the recovery was always rapid and satisfactory. Like the vertiginous attack called the "vapors," which appears to have been so prevalent at one time in court and mansion, the emotional syncope of a later era, following the course of an absurd and feeble fashion, became contagious by imitation. In our time such manifestation of the phenomenon is exceptional, but syncope from strong emotional causes is still often witnessed amongst persons of both sexes who are of excitable and nervous constitution. Fear and the anxiety connected with the shock of sudden news are the two emotional states which lead to the faintness or deliquium. The syncope may be quite sudden, as though the heart had stopped immediately in its beat; but it is more usually preceded by a palpitation with fulness in the throat, coldness of the surface of the body, giddiness and muscular failure. From the faintness the body falls, and the heart, relieved by the recumbent position, usually regains its power, upon which there is recovery.

This is the most favorable view of the course of syncope from emotion. There is a more serious side. In the community there is always a population in whom the balance of the circulation is so delicate, and in whom the heart is so enfeebled, that syncope from emotional causes is at all times a grave and sometimes a fatal catastrophe. A large number of sudden deaths is due to syncope induced through emotional impressions.

Emotional Paralysis and Apoplexy.

In states of the nervous system, where from the progress of organic nervous disease the danger of nervous seizure is imminent, the effects of emotional excitement sometimes tell with great effect upon the body, through the nervous system. Slight emotional attacks frequently repeated, or constant emotions like those resulting from anxiety, or sudden attacks like those resulting from fear or rage, are all sufficient to bring out, slowly or rapidly, according to their intensity, the nervous affection or stroke, which may be a stroke of palsy, or an apoplectic stroke.

The stroke of paralysis is most commonly induced by a series of emotional attacks dependent upon anxiety, and ending, perhaps, in something that is more than usually oppressive. In certain instances the paralysis is at first temporary in its character, and is rather of the hysterical than of the true kind, so that recovery takes place. In other instances the paralysis is local, attacking temporarily the eyelid,—ptosis,—or affecting one side of the mouth, or one or other of the limbs. In pronounced instances it is decisive, affecting, probably, one half of the body, and exhibiting all the phenomena, described at page 176, of paralysis.

Apoplexy induced by emotion, in persons predisposed to the affection, is sudden in its development, and is developed, in point of fact, as if it had been produced by a direct physical blow. As fear is the passion leading most frequently to syncope, so anger is the passion leading most distinctly to apoplectic seizure. In the glow of the passion of anger the brain is surcharged with blood and the attack is immediate. Or, when the rage has passed the congestion of reaction leads to engorgement of the vessels of the brain with the same result, an arrest of the circulation in the brain and a stroke of insensibility. The number of persons who die from apoplexy under emotional excitement is very considerable.

Emotional Delusion and Melancholy.

Under emotional excitement persons of a susceptible temperament become in certain cases charged with peculiar delusions, which never, perhaps, thoroughly pass away, but which may be

so intensified as to produce tendencies decisively insane. A sudden terror is the commonest cause of this condition of disease. A gentleman who was long under my care afforded a striking illustration of this fact. As a boy he had a supreme dread of water, and his father for that reason, and with the best intentions, determined that he should be taught to swim. He was taken by his tutor, in whom he had the fullest confidence, to the side of a river, and when he was undressed he suddenly found himself cast, by his instructor, into the stream. There was no danger of drowning, for the tutor was at once in the water to hold him up and bring him to land; but the immediate effect on the boy was faintness from fear, followed quickly by vomiting, and severe nervous symptoms. He had constant dread that some one was about to repeat the infliction; he dreamed of the event by night, he dwelt upon it by day. As he grew older he became suspicious of all around him, and at last, under a most absurd delusion that he was the victim of a conspiracy, his mind gave way, and he died insane.

Melancholic symptoms, accompanied with indications of organic nervous feebleness, are apt to become developed from prolonged grief, especially when the person influenced by the passion of grief has approached or passed the meridian of life. A constant desire for rest, for seclusion, for avoidance of cares of the world mark this form of disease. It is not disease leading, necessarily, to rapid failure of further physical or mental power, for the mind and body are subdued so equally there is no galling irritability, no wearing depression from the influence of other passions. The worst that happens, ultimately, in these instances is the gradual but premature encroachment of dementia previous to death, if the life be prolonged to its natural term.

Melancholy from emotion sometimes follows from an excitement of another form; namely, that which is engendered from various kinds of religious emotional states. In some natures the influence of religious excitement leads primarily to an ecstasy and enthusiasm under which the vascular system is greatly excited, and, through it, the nervous. The excitement, if it be not subdued or chastened, drops, after a time, into a settled melancholy, attended, occasionally, with an extreme hardness and even moroseness of mind. In other natures the effect of religious excitement is directly towards gloom and melancholy, with brooding doubts

respecting certain particular beliefs, or regarding certain texts or passages of scripture. The saddest forms of melancholy are now and then traceable to this origin. I have known three cases in which self-accusation of sin, which it was believed could never be forgiven, has led the self-accused to commit suicide under the conviction, logical in its way, that as no suffering could be worse than the continuance of life, death might possibly be a solution of all the trouble.

By political excitements, and by these particularly, when they lead to strife and war, various mental aberrations, ranging from maniacal passion to melancholy, are acquired. This fact was illustrated with much force by Dr. Stokes of the Mount Hope Institution of Baltimore after the last great American struggle. One victim of the political war mania is cursed,—so runs the description,—with fear until he fails to sleep; another sinks into gloom, believing all his estates are confiscated; a third imagines himself taking part in some bloody fray; a fourth, the subject of delusions through the sense of hearing, no sooner sleeps than he wakes up, roused by what he considers to be awful sounds afar off, but approaching near.

Accidental Diseases from Emotion.

Certain accidental diseases are developed occasionally under the influence of the passions. I once saw that enlargement of the thyroid gland, described at page 227 under the term "goitre," developed under a sudden impulse of grief, during which the suffering person continued for many days to keep up a sobbing cry. In another instance I witnessed the phenomenon of hæmoptysis, or spitting of blood, induced by rage. In a third instance, under the influence of the passion of rage, actual blindness, lasting for some hours, and attended with severe throbbing and pain in the eyeballs and head, followed the passionate impulse.

CHAPTER VII.

ACQUIRED DISEASE FROM HABITS OF LIFE.

Apart from all the influences acting upon the body through the mind, to which the attention of the reader has been drawn in the last few chapters, there are some others which require to be studied, and which are commonly known as individual habits or habitudes. Some habits of an injurious kind, alcohol drinking and tobacco smoking for example, have already been discussed, and need not be referred to again. Those that remain are habits of irregular rest and sleep; of worry in relation to business, occupation, or pleasure; of excessive mental strain from overwork or over desire; sedentary habits; and habits of moral failure.

From all these habits, carried to excess, some changes, physical or mental, or both, amounting often to actual disease of body, of mind, or of both, are to be detected amongst various classes of our communities. The diseases thus acquired are seated specially in the digestive, the circulatory, and the nervous systems; but the nervous systems suffer most, and are, usually, first affected.

Diseases of the Digestive System from Habit.

Persons who are closely engaged in pursuits of a sedentary kind are very liable to suffer from inaction of the digestive organs, and from what they designate inactivity of the liver, a term general enough but not wanting in correctness. The sedentary habit leads to slow secretion of bile, slow circulation through the liver and the other parts of the digestive system, and therewith to indigestion, and, as a general rule, to constipation. The obstruction of the circulation through the liver has often the further effect of inducing hemorrhoids. Persons suffering in this manner from the sedentary life gain, in addition to the dyspepsia, a tendency to become fat and unwieldy. They are

much depressed in spirits, disinclined for exercise, and are easily affected by alternations of cold and heat. They are vitally reduced in power, and are prone to suffer from degeneration of the tissues. They generally become prematurely old.

Diseases of the Circulation from Habit.

Diseases of the Heart.

Those who are engaged in hazardous and speculative pursuits, and who get into the habit of irregular business life, and particularly into the habit of laying out plans and devices which shall be sure to win, are almost always checked, comparatively early in their careers, by disturbances commencing in the circulation. Their earlier symptoms are, commonly, those of irregular action of the heart, followed by results pertaining to failure of that organ. Exposed under these circumstances to a variety of exhausting influences, their mind becomes intensely irritable, loses its ready quickness, or goes off its balance altogether. Such persons frequently succumb to some sub-acute inflammatory disease. They take cold, suffer from congestion of the lungs or kidneys, and, unable to bear the shock, sink rapidly under it.

Diseases of the Blood-vessels.

The long-continued habit of standing while at work is provocative of some diseases of the blood-vessels which may become of serious import. Varicose veins in the lower limbs are significant changes connected with the habit of standing for a long time at work. In persons engaged in trade, and who stand for many hours behind the counter; in persons engaged at the desk for long hours in a standing position; and, in others similarly circumstanced as regards mode of work, this enlargement or varicosity of vein is very liable to occur.

In like manner the hemorrhoidal veins, to which reference has more than once been made, are apt to become congested from long standing, by which means the disease called hemorrhoids is a very common consequence.

The evils resulting from maintaining the erect position for long intervals, in combination with limited exercise, extend also

beyond the production of the local conditions of disease just named,—varicose veins and hemorrhoids.

By the erect position the course of the blood through the great abdominal veins to the heart is much impeded, and as the larger veins are destitute of valves, the back weight of blood, to use a simple term, soon becomes considerably telling in its effect. It checks the course of the arterial current indirectly; it checks the course of the intermediate or capillary current directly; and thus leads to congestion of the vascular organs in the abdomen, as the liver, the spleen, the kidney, and often the mucous membrane of the intestinal canal itself. From this mechanical obstruction what is called sluggish action of the internal organs is exceedingly frequent amongst those persons who are engaged in occupations which keep them on their feet for long periods of time.

The mischief is specially serious in women who are employed for long hours in shops, and who are not allowed the privilege of a seat. In them the internal congestion to which I have above referred extends to the uterine organs, and is a source, almost of necessity, of great pain on many occasions, followed by organic changes, in some instances, in which the commencements of actual disease are made. If the reader will turn back to the section entitled, "Diseases Special to the Female Subject," pp. 220–224, it will be seen that several forms of disease are likely to be induced, or, if not induced, intensified, in the female by the habit which is now under consideration. The various diseases of the uterine system; catarrh, inflammation, ulceration, and abrasion; the various mechanical affections; the various diseases of the appendages of the uterus; and, all the different functional diseases will, without failure, be unfavorably influenced by the habit of standing for long hours in a limited or constrained position.

Diseases of the Nervous System from Habit.

Physical Nervous Failure.

In the professional classes unfavorable habits of life lead to various degrees of nervous failure. The professional classes differ from others in many points. They differ from original brain-workers in that they rarely study intensely at original designs, and they differ from the speculator in that they have little en-

thusiasm. Learned in matters of fact and principle, they put their knowledge into practice on behalf of others, and, recognizing the faults, failings, and miseries of humanity, they know no surprises. They learn with the preacher that all things are alike to all, and for many active years of life they are trained, by their habits, to pass through labors and difficulties which seem to others insurmountable. There comes, however, at last a time even with some of these when the nervous system shows symptoms of premature failure, and when success seems to bring cares which appear harder to bear than failure itself. They weary of continual routine, they weary of praise, and they lose the pride which was once attached to responsibility.

As in the members of this class the brain is constantly being exercised without enthusiasm, and as the body is often exercised without sufficient rest, they rarely suffer from excitement of brain, while they easily suffer, after middle life, from those physical ailments which follow as secondary to the overworked nervous system. Their habits lead, that is to say, to physical nervous failures. Diabetes is common in these classes. Paralysis of the limbs, with little disturbance of the mental faculties, is another common type of disease amongst them. Affection of the kidneys, degeneration of the structure of those organs, is a third typical condition; and disorganization of the structure of the heart is another and by no means rare occurrence.

Insomnia or Sleeplessness.

The habit of keeping irregular hours of sleep, and of taking too little sleep, leads to serious forms of disease, and indeed I know of no habit which helps more surely to shorten life than that of fighting against natural periods of rest. I have seen the effects of this habit in members of my own profession; in members of the dramatic profession, who too often set up a new world of their own when the rest of the world is in sleep; in politicians; in scholars, who habitually incline to work through the night; and, in many more who are obliged by their occupation to watch while others sleep. In all these classes I have seen nothing but universal evil from the habit, imposed or self-imposed, of broken rest.

In this observation I do not want rigidly to maintain that sleep must necessarily be taken at certain particular hours. I

believe it to be best to take it at certain hours, including the first hours of the night, but I am now describing the effects following the habit of sleeplessness, in season and out of season, and the insomnia which is generated by such habit.

In persons of vigorous constitution the habit of disregarding proper sleep, and the insomnia which springs from it, may go on for several years without any apparent bad effect. In time, however, it is certain to produce its natural consequences. The first indications of danger are irritability of mind and feverish excitement, followed by depression, pallor, and deficiency of appetite. These are succeeded by fits of unconsciousness, in which the affected person positively sleeps, and, it may be, sleeps soundly, without himself knowing the fact. In this way he gets rest, which for a little while may give a certain measure of relief; but soon the nervous failure increases, and one of two results succeeds. He either falls into a sleep which becomes a coma, and terminates in death, or he continues sleepless, unless artificially made to sleep by narcotics, and with progressing failing powers sinks into paralysis, to succumb from that affection.

In exceptional cases the insomniac makes a fair recovery. Under regulated mode of life, and especially under the regulation which leads the sufferer to go to bed at unusually early hours, such as eight or nine o'clock, whether he can sleep or not at first, the insomnia or sleeplessness is often cured without any artificial aid. It is, however, apt to return after mental strain or worry, and indeed may be expected always to return if the strain or worry be severe or prolonged.

Dementia and Mental Nervous Failure.

There exist amongst us men who acquire the habit of working at some particular mental occupation to such an excess that they destroy thereby, in a very brief period of time, their mental nervous life, and fall into what is technically called dementia. The habit which leads to this condition is not usually that of mere overwork, but is one of restless occupation accompanied with incessant worry, trouble, and excitement, often with deficiency of rest; or, a too absorbing singleness of thought on one topic; or, too heated an enthusiasm; or, an unnatural fostering of speculative inquiries.

The signs which indicate the advance of dementia from such

overwork are much the same in all men, however different their spheres of action may be. The first sign is a self-consciousness of want of full vigor, not only of mind, but of body. This symptom, as a common rule, is altogether disregarded, or is felt to be a contemptible but troublesome fact which it were folly even to recognize. It is succeeded by restlessness of mind and more than ordinary craving for work, with disturbed sleep, and, by no means rarely, with involuntary movements of the muscles of the body at the time of lying down, or during efforts to seek repose. With these symptoms are blended a peculiar and acute sensitiveness to external impressions and influences, and to the ideas of influences which are not directly visible. Lines, figures, colors, ocular spectres of various kinds and new to the senses, start up in the field of vision; sounds, ringing or dull, booming, or sharp and startling, or harsh and grating, molest the ear; while ordinary sights and sounds are disturbed, the agreeable being overrated, the disagreeable condemned without reason or measure.

In the order of events, in a progressive case, these signs of overwork are confined, it may be, for months or years, to the knowledge of the man himself. Friends see in him merely a man overwhelmed with anxieties, and, as they commonly say, "too anxious," and therefore too hasty. The man himself recognizes the excitability of his life with some dread at first; but he soon becomes familiarized with his condition, and with the objective evidence of phenomena which, according to common experience, ought not to be present. He accepts unnatural creations as natural, feels himself accustomed to them, and may find in them the subject of an easy and vacant contemplation. The hypothesis of ghostly manifestations and the hypothesis of ecstatic vision find often a common origin in this stage.

The next most characteristic prognostication of progressive disease is a sensation on the part of the patient of necessity, during any mental effort, for frequent rest and sleep; symptoms such as are described so faithfully by Johnson in reference to the end of the poet Collins. The course of these cases is usually clear. It is a steady course towards a general palsy of mind and body, and is not unlike the decline of mental activity in the age of second childishness. When this condition exists, at however early a stage, the slightest shock tells on the nervous structures, and transforms suddenly the threatening malady into the extreme

reality. Sudden muscular paralysis is the most common sequence of shock under this condition; it is in most cases, at first, a local paralysis; but it may at once become general in respect to all the muscular system which is under the control of the centres of volition.

It has been observed in some cases where the habit of excessive mental work has been carried to an extreme that chronic eruptions of the skin make their appearance. That this is true I think there is little cause for doubt. I have seen, for example, the diseases *psoriasis* and *pityriasis rubra* break out in an acute form under the conditions stated, as well as some other eruptions of a specific kind. It must, however, be understood that in such examples the predisposition to the diseases named already existed, and that the mental exhaustion was supplemented by depressing influences of a physical character.

Nervous Exhaustion in Early Life from Habit of Mental Strain.

There are some diseases of a nervous character, indicated by great nervous exhaustion or failure, which are due to certain habits to which the young are subjected, or which the young contract by imitation, and which call for particular notice in this chapter.

These nervous diseases are amongst the most important of all, because every affection of the nervous organism contracted during the period destined for active physical growth and development of the body is of necessity detrimental to the future of life, and is certain to interrupt the completion of perfect life.

The habit of enforced mental training, or "culture," as it is often called, now prevailing to the most dangerous extent, is one of the causes of nervous failure and incapacity threatening the future generations of women and men.

The endeavor to fill the minds of the young with an excess of knowledge, carried to a habit of a forced character, produces, apart from its failure as a true educational result, distinct physical mischiefs, in forms of bad health or disease, which are, usually, very significant. In children who have a marked predisposition to tubercular affection, the effect of habitual overwork of the brain is to favor the occurrence of inflammatory tubercular disease and tubercular deposit in or upon the brain. In chil-

dren who are not specifically disposed to tubercle, but who are of nervous temperament, the oppression on the brain tends to congestion of that organ, and to the production of attacks of convulsion, it may be, of an epileptic character. In less serious cases the overwork causes weakness and exhaustion both of mind and body, with dyspepsia, carelessness for active exercise, imperfect sleep, reduced growth, limited expansion of the chest, and anæmia. When, in short, the brain is habitually overworked in the growing child, however well the child may be fed and clothed and cared for, there will be overwaste of nervous power in proportion to the overwork, ending, naturally, in the formation of a bad physical body.

In the more advanced young the habit of excessive mental culture is supplemented most injuriously by the further habit of preparation for stiff examinations, and of trying to go through the ordeal of examination. These efforts lead to intense emotional anxiety and to many of the consequences already described as resulting from that injury. I have recently had before me a youth who, under pressure of examination, has been affected with intermittency of the heart to such a degree and in a manner so permanent, that he may be considered as disabled for life.

In young women subjected to the same strain, from the habit of preparation for the same kind of ordeal, the mischiefs inflicted are still more decisive. Such victims to a false system are often made unfit for further pursuit of useful knowledge, and are mentally as well as physically enfeebled. They of all are least prepared for the active responsibilities of after life, and if they marry they run the special risk of giving birth to children who will share with them in the many failures and feeblenesses which they have been made to acquire in the fatal trial of mental against physical power.

In both sexes the habit of mental strain leads to broken and irregular hours of rest, to insomnia more or less severe, and to the results which follow, in order of natural progress, from the sleepless state. The effect is not, commonly, a success during the time the strain is being put on. Afterwards, all is loss. The failure of general health carries with it comparative failure in every effort of life, with a resultant unhappiness which intensifies the original error, and to trouble adds trouble.

Nervous Failure from Habit of Sloth.

Another form of nervous failure from habit occurs from the opposite of mental strain, namely, idleness, or, to use a more expressive phrase, sloth. There are several classes of what are called idlers. I have elsewhere divided these classes into three, a division which on further reflection I still think holds good. One includes the class of idlers who are idle by actual hereditary taint of feebleness. Another takes in those who have been industrious, mentally and bodily, for many years of life, but who, becoming surfeited with work and being satisfied with the results of their labor by the competency they have obtained, retire, as they say, and seek for rest in an enforced repose of life. A third is made up of those most unfortunate pets and pests of society who in the family and friendly circles are considered too weak, or too good, or too superior to be subjected to any work of a useful kind, and who are thus trained to conceive that they confer a privilege when, in allowing others to wait upon them, they are not too exacting in their demands.

The first of these representative classes, and they are truly representative, are born, as a rule, of idle and luxurious parents, or of parents who, in early life, have worn themselves out in the struggle for life, or in the effort to attain some distinction or success. Such born are deficient in organic construction. Their centres of will are incompetent for the performance of duties which, by the majority of mankind, are considered the commonest duties. They lie midway between the actually imbecile and the feeble industrious. With their mental inactivity they commonly present some physical infirmity. They are often scrofulous; they have feeble muscles, effeminate voice, and thin or anæmic blood; some are lank of limb, sunken of face, and spare of body; others, even early in life, grow very fat, so as to become a burden to themselves. They are all slow to learn and retain only for a short time that which they have learned. They are singularly helpless with their hands, their wrists drop as if their extensors were paralyzed, and they usually have small and aberrant eyes. As children, these unfortunates, unless they are well protected, lead wretched existences: at school they are the butts of their stronger companions, and the torments of their teachers, who fail equally by persuasions, rewards, blows, to make them

active or learned. Happily for themselves they are less sensitive than their fellows; and, almost happily for themselves, they are usually short-lived. Possessing no cerebral resistance, they rapidly sink from acute disease, from accident, or even from moderate physical efforts into which they may, in emergency, be peremptorily forced.

The nominal diseases under which members of this class suffer and from which they die are chiefly those of a nervous type, diseases like epilepsy, chorea, and paralysis; but they also are prone to suffer more than others from the inflammatory affections, from the zymotic diseases, from physical accidents, and from mental depression. Many of them inherit rheumatic and gouty proclivities, under which they easily succumb when those affections take acute form. They are all incapable of bearing any mental or physical strain, and fail rapidly when subjected to privation or hardship. They represent, in a word, in the most signal manner that order of society which is said to be of "bad constitution."

The sufferers from idleness of the second class, those I mean who have earned what they call repose from actual work by their preceding industry, suffer also from nervous failure rather than from other form of disease. These become depressed in spirit, feel that life is a burden, try to fill up their leisure with some new occupation with which their minds are not familiar, and with which their hands never become familiar if a manual labor be the one selected. Trying a number of things all round, and failing to obtain that which they want, a few, wisely, go back to their old work, while others fall into hypochondriacal ennui, which may be, and sometimes is, so intense that life becomes too intolerable to be borne, in which condition what certain writers have called "justifiable suicide" is the final result.

Others of this class of rusting idlers kill time by rushing into dissipation. They determine to enjoy life at all costs, take excess of food or excess of drink, or both, acquire, thereby, a feeble heart, an inactive liver, and a deranged vascular mechanism altogether. In this condition they fall, with the greatest readiness, from any depressing cause or shock, often dying suddenly from syncope, apoplexy, or paralytic stroke.

The idlers of the third class, those who become idle by acquiring the habit, and who are encouraged in it by the indulgence

or apathy of friends, suffer through life a feebleness from inertia rather than acute disease of any kind. They rarely show what are called acute symptoms when they are subject to diseases which in other persons assume the acute form, while they often struggle, as it were, through these diseases with a pertinacity that is astonishing to the by-standers who are acquainted with their natural inactivity and apparent feebleness. At the same time, they know nothing of that true happiness which springs from activity of life. The men are apt to become dissolute from drink, and to acquire that abject helplessness which ends in dipsomania or general paralysis. The women grow up hysterical, feeble, timid. If they marry they become the helpless mothers of helpless children, and intolerable anxieties to their husbands and friends. Left to their fate, they sink into slatternly misery, lose their good looks, and, like the equally idle men, fall at last into complete nervous failure and premature old age. These, too, like the men, are apt to indulge in intemperate habits, upon which they become ready victims to alcoholic degenerations of bodily structure. Finally, amongst all these classes of men and women who suffer from sloth or idleness, there is a tendency under the most favorable conditions and best advice for them to sink into mental failure and despondency, in which state, unfortunately, if they become the mothers or fathers of children, the children inherit the failing; and, the faults of one generation, be they hereditary or be they acquired, pass to another.

Nervous Derangement and Degeneration from Habit of Luxurious Feeding.

The nervous system is liable to undergo degenerative, and especially fatty degenerative changes from the effects of habits in which idle and luxurious modes of life are combined with excessive indulgence in rich foods, as if life were intended to be nothing more than a gluttonous feast. Amongst all classes of our communities there is too great a desire for excess of food, and too great a tax put upon the digestive organs for digestive work.

Under excess of food there are several varieties of injury inflicted upon the body. Some of these injuries are local rather than general, and are confined to the digestive surfaces and the skin. In the year 1854 a peculiar form of disease broke out

amongst the convicts of the convict establishment of Freemantle in Western Australia, owing to the effects of an excessive dietary. The reason assigned by the authorities for this plan was that a body of men were more easily managed when well clad, well lodged, and supplied with more food than would satisfy their animal cravings. Treated on this plan they could be more readily punished by the withdrawal of their luxuries. The experiment went on until it was stopped by the report made, on the question of the results, by Dr. Rennie. The total weight of food allowed per day to each man reached the weight of fifty-nine ounces of solid substance, with sixty-seven ounces of fluid, and this, to men who were not at the time exposed to severe labor, and who were living in a genial climate. The food supplied was of mixed kind, consisting of animal food, bread, potatoes, tea, soup, rice, barley, and oatmeal. Of 1554 persons thus fed the vast majority suffered from one of three classes of disease—(*a*) diseases of the digestive organs; (*b*) inflammatory affections of the eyes; (*c*) cutaneous eruptions. The most marked train of symptoms was dyspeptic in character. The dyspepsia was characterized by great uneasiness in the stomach, cough, difficulty in swallowing, and constipation. Under reduction of diet the induced diseases were, easily, made to pass away.

I was once consulted in a series of cases nearly identical with the above. The sufferers were the servants of a great house where the utmost extravagance prevailed, and where the dependents sat down regularly to four meals a day, at each of which animal food was taken at pleasure. A number of cases of extreme dyspepsia occurred and recurred, and were attributed, even by myself at first, to every cause except the correct one. At length the truth dawned upon me, and a rectification in the system of dietary very soon brought about a complete removal of the induced diaease. There is, in fact, as Dr. Andrew Combe ably illustrated, so strict a limit to the powers of the natural secreting and excreting organs, that under an excess of overwork these organs cease to act in great part, and upon this various derangements, amongst which dyspepsia is the most prominent, inevitably stand forth.

There may, therefore, be induced disease from actual quantity of food taken, though that itself be of the simplest and, it may be, of the purest kind in its way. But more than this lies

behind. There may be induced disease from the richness and variety of foods consumed on a single occasion, or on a series of occasions following quickly the one upon the other. Many of the acute attacks of dyspepsia which succeed banquetings are due, in part, to this cause, although, no doubt, additional evil also comes from the wines and strong drinks which are not foods, but which form, nevertheless, a part of the entertainment. There are hosts of people who are never free from dyspepsia owing to the practice of daily banqueting, of making the dinner-table the feast of each day, and of tasting in that delight what they think to be the grand pleasure of life. Such persons almost always die prematurely of some disease of the digestive organs, or of the secreting glands, which parts they literally wear out long before the rest of the body has reached its decline.

Lastly, persons who are given to luxurious feeding are subject to degenerations of the nervous centres and of other organs, under which they become universally diseased, affected in every vital part, so that they fall under the merest accident of acute physical or mental disturbance. They take too much of every kind of food; of the colloidal or flesh-building foods; of the fatty, starchy, saccharine, or heat-giving foods; of the mineral or bone-forming foods; of the liquid or watery foods. The excess of the flesh-forming substances causes the heart and other working muscles to increase in size, while the kidneys are taxed to the extremest degree in disposing of the products of decomposition which have to be eliminated by them. The excess of fat-forming substance leads to deposition of fatty substance all through the body, and to fatty degenerations or changes, varying in degree from simple obesity to muscular inactivity and to fatty muscular deterioration, in which last change the heart, perhaps, partakes more readily than any other of the muscular organs. The excess of mineral food throws more work on the kidney and other excreting surfaces, by which so much of that food as cannot be applied for building up the harder tissues of the body has to be eliminated.

In the degenerative changes which follow upon the reception of excess of food into the body the nervous system shares acutely from the first. The demands made upon it for active work are severest of the severe throughout the whole of the period of disorganization, and it is therefore soon incompetent to meet a sud-

den emergency, or to sustain the mind and body when, often, they need its fullest sustainment. There occur also, in the course of these events, changes of degeneration in the nervous matter, fatty changes especially, under which the nervous functions are impaired, the premature age of the affected body is quickly and decidedly pronounced, and the value of life is reduced to the lowest possible degree consistent with living action. Then comes the end, when, under some extra, but to the healthy body trifling, strain, the life altogether ceases.

Under some special conditions of body even moderate indulgence in the use of food is directly injurious. Mr. Roberton of Manchester first pointed out, and his wide experience has been confirmed, that many of the accidents of disease, particularly those affecting the nervous system, which occur to women during and after childbirth, are most common in women who are overfed, and are almost unknown amongst those who are moderately or even scantily fed. Certain it is, in brief, that the luxurious class of feeders are infinitely more exposed to danger from every variety of nervous shock than the moderate and abstemious, and that abstinence, unless carried to positive privation, is safety itself as compared with its counterpart.

Nervous Exhaustion from Secret Immoral Habit.

It would be shirking truth for the purpose of avoiding a painful and unpleasant subject were no mention to be made of a nervous disease incident to a habit which is often acquired by the young of both sexes. In this affection nervous excitement, induced by irritation of the sexual organs, sets up a most lamentable condition of disease of mind as well as of body. The affection is the result of a moral contagious secret vice which, infecting the young before they have knowledge of the evil or reason to control themselves, leads them into a train of symptoms which are as specific as they are pitiable. The first bad effects of the habit in question are the tendency it excites to repetition of itself, and the mad persistency with which that repetition is carried out. In course of time the natural life becomes changed, and the manifestation of what are, ordinarily, called nervous symptoms is declared. The sufferer is rendered irritable, indecisive; is unable to carry out usual tasks or duties with energy and ability; is afraid to face the most common events in life; avoids strangers,

or acquaintances, or, it may be, friends; shows startings and apprehensions on the commonest alarms; and, has a desire for a solitude which too frequently leads to further indulgence in the cause of all the evil. These states of body and mind are evidenced by objective as well as subjective symptoms. The sufferer, who looks pale and anæmic, is affected with loss of appetite and imperfect digestion, and is often haunted with the most intense mental depression and melancholy. There is a sense of constant irritability in the organs subjected to irritation, and in very bad cases affecting the male sex, physical changes of wasting in them, with involuntary excretion. In such extreme examples the body, generally, wastes, while the brain and other nervous centres lose their perfect controlling power. The mind, under these untoward states of body, is soon brought into deep depression and melancholy, during which the illness, bad as it may be, is much more dreaded than it need to be. The impression fixed on the mind, in many of these cases, is, that recovery is impossible, and that the course of life must be a continuous and hopeless misery.

During this forlorn frame of mind the patients to whom reference is here made are wont to consult the lowest and most ignorant of those false pretenders to medical knowledge and skill who lie in wait to prey upon them, and who, by exaggerating the danger, make the return to health exceedingly more prolonged. The sufferers are truly to be pitied, because in fact there are very few instances of the disease in which recovery cannot be insured, under firm and temperate advice, by the conveyance of confidence that convalescence is certain if the habit be given up, and by the simple and scientific methods of treatment which every properly qualified practitioner of medicine, one as well as another, has at command.

In the ordinary course of events the recovery from the effects of this disease is practically insured so soon as the habit is given up, and the mind ceases to brood on the ideas of the disastrous consequences with which it has been stored. Time, however, is always required for natural cure, and a period extending over some months, at least, should always be named as necessary for the completion of recovery.

While holding out those facts as explanatory of the professional experience common to all reliable professors of medical

art, it ought not to be concealed that, exceptionally, some serious results are apt to ensue beyond what have been stated. I have known, and other physicians have known, instances in which epileptic seizures have resulted from the disease, or in which a violent and helpless mania, attended with almost automatic repetition of the habit, have followed upon it.

The same kind of experience does not fail to detect that, in women, hysteria of an intense and protracted character is another sequence; and that, both in the male and female sex, any latent tendencies to tubercular affection of the lung, the brain, or other susceptible organ are unfavorably influenced or advanced by the affection. But even in these exceptional examples recovery from the effects of the habit, and from certain local derangements which may have been also acquired by it, are frequently secured if the patient is consistent, hopeful, and enduring.

The most dejected sufferer from the disease may, therefore, always have hope of recovery, and in ninety-nine cases out of a hundred will realize that hope fully if the cause of the symptoms be scrupulously avoided, and if those who trade upon the suffering be shunned with equal resolution.

BOOK THE THIRD.

A PRACTICAL SUMMARY OF THE ORIGINS, CAUSES, AND PREVENTIONS OF DISEASE.

ORIGINS, CAUSES, AND PREVENTIONS OF DISEASE.

In the two preceding books we have studied the phenomena of disease, natural or acquired. We come now to the considerations of origins and causes. Why do the phenomena of disease exist, and how are they to be prevented? These are the questions that lie before us at this moment.

Origins and Causes. Definitions.

The first question is one of exceeding difficulty, except when, as in the course of the acquired diseases, and a few of the natural, we see the cause lying plainly before us. In the large majority of diseases the original cause is either concealed, or is so complicated with other causes we are unable to trace it out as a distinct agency.

For example, when we speak of hereditary causes of disease, we are usually obliged to connect these with some other influence which is at work to produce the outbreak. When we speak of atmospherical causes we are constantly obliged to connect these with some other agency, hereditary, acquired, or accidental. When we speak of contagion as a cause we are often forced to connect this with something else, such as hereditary, atmospherical peculiarity, or the mental or physical condition of the affected at the time when the affection was induced. Nay, when we have even to discuss the origin of acquired diseases, though we may know the way in which they have been acquired, it is not unfrequently necessary to connect them with some pre-existent condition or state by which the influence or cause calling them into existence was favorably assisted in its work.

From these varying circumstances the term, "origins," or "causes," as applied to disease, is often qualified by the addition

of an adjective which the more clearly defines it. Thus, if a condition of body pre-exists which tends to promote the development of any given disease on the application or action of some other agent, the pre-existent condition is the *predisposing* cause, while the agent which called the disease directly into action is the *exciting* cause. For instance, a person who has not suffered from small-pox or from vaccination will take, in most cases, either of these diseases if properly exposed to the small-pox or vaccine matter. The condition which favored the production of the small-pox or vaccination is here the predisposing, while the small-pox or vaccine virus is the exciting cause of the affection.

It sometimes happens that towards the development of a disease there is yet another factor. The person may be predisposed to the affection; he may be exposed to the exciting cause of the affection, and yet he may not take the affection unless some atmospherical or other *disposing* condition adds its influence.

Not to enter into further details, there are, then, as will be seen, at least three classes of causes of disease: the predisposing, the disposing, and the exciting. I shall not attempt to define or classify these in any systematic form, since by such course I should be led into a controversial rather than a practical line. But, using the words origin and cause in their general sense, I shall refer, incidentally, to the positions which they are supposed to take, on each occasion, as the description proceeds.

From these general definitions we might now commence at once to treat of the various classes of causes, in detail; but before doing so it is worth while to add a few sentences relating to the number of diseases which require to be studied in a systematic manner in connection with the subject of origins and causes.

Causes in Relation to Number of Diseases.

If we were to review every disease and diseased condition which has been introduced into this volume, we should have to take in hand more than a thousand distinct facts of disease, and to seek for the causes of each fact. This would be an unending task, leading to discussion of endless hypothesis, and yielding on the whole, if accomplished, a not very profitable history. It will be better, therefore, to confine our observations to the causes and origins of the more common diseases, those diseases which

yield the ordinary mortalities, and which, successfully combated, would leave little to be done in the way either of prevention or cure.

By this plan the number of diseases,—the causes of which have to be sought,—is reduced to al ittle below a hundred, even if a few diseases which do not add to the mortality tables be included. We include, for example, in this manner, all the diseases that are tabulated from week to week in the Registrar-General's Report under their different heads. We include the zymotic diseases; the parasitic; the constitutional, such as rheumatic fever, gout, cancer, consumption; those connected with some default of vital power, such as premature birth and old age; the local diseases of the different systems of the body, digestive, circulating, breathing, nervous, sensory, glandular, muscular, osseous, and membranous. We include, in like manner, the violent deaths, by accident, homicide, and suicide. Lastly, we include what the Registrar-General puts under the head of "other causes;" and, if we count up the whole, we discover that between ninety and a hundred definable diseases make up the list.

When from causes of disease we turn to preventions, the plan of limiting the number of diseases referred to immediately above tells with equal force. If we could discover means for removing the causes of these more common and fatal diseases; in other words, if we could discover the means of preventing these diseases, the whole field of disease would be so reduced there would be little left to be done except to maintain, systematically, the methods of prevention in all their integrity.

There is no doubt that a large amount of success in the way of prevention could be carried out by a few simple, determinate, and continued efforts to remove certain of the worst offending origins and causes, and the two subjects come therefore, appropriately, for study in one book, prevention being the natural supplement to the study of causation.

We shall see, indeed, as we proceed, that so closely do these two lines of study run together that the possession of the knowledge of one,—the knowledge of cause,—leads, almost invariably, to the possession of knowledge for prevention, that is to say, to knowledge which will lead to the removal of the cause. The fact leads me to divide this book into two parts, in one of which I dwell on the origins and causes of diseases, first, generally, and

afterwards in detail; while in the other I treat upon removals of causes, preventions or preventive measures.

Causes Natural and Acquired.

Before proceeding further with the perusal of this third book, the reader will do well to turn back to the two previous books and to compare the one with the other. It will then be seen that a great many of the diseases which are included in the second book, and which, as is there stated, are induced or acquired by those who suffer from them, are closely allied in character to, if they are not identical with, many of the affections which spring from pure natural causes, and take, from their similarities, the same names. The difference, indeed, between the two depends, in most cases, on the circumstance, that whereas in the natural forms of disease the cause is undiscovered or obscure, in the acquired disease the cause is entirely known.

As our learning on the question of natural causes advances, all the facts pertaining to self-induced or acquired causes become of great value in explanation; for as the same phenomena must, almost of necessity, be dependent upon what is practically the same cause, the study of the effects of known causes passes into experimental observation from experiments accidentally and repeatedly presented, when the mind is directed to the study of original comparison and research.

BOOK III.

PART THE FIRST.

ORIGINS AND CAUSES OF DISEASE.

CHAPTER I.

VARIETIES OF ORIGINS AND CAUSES OF DISEASE.

With the understanding rendered in the preceding introduction, I divide the origins and causes of diseases into the seven following classes:—

I. Congenital, Hereditary, and Constitutional Origins and Causes.

Under this head is included those influences, chiefly predisposing, which lead to disease by descent; influences, that is to say, which descend from parent to offspring. Diseases connected with such tendencies, and seeming to descend as stated, are called *hereditary* diseases or *constitutional* diseases, and under some circumstances *diathetic* diseases, that is to say, diseases dependent upon a peculiar disposition of body, or mind, or both.

II. Atmospherical or Meteorological Origins and Causes.

Under this head is included those conditions of the atmosphere which serve as causes, predisposing or exciting, of different kinds of disease. The atmospheric causes include a large range. Amongst them may be named varieties of season, and of heat and cold; variations of atmospheric pressure; differences of moisture in the air; winds; differences of electrical condition. Sometimes these atmospherical variations in relation to disease are spoken of as *meteorological* causes of disease.

III. Parasitical Origins and Causes.

Under the head of parasitical origins and causes are included various minute living forms derived from the animal or vegetable world, which, entering into the internal organs of the body, induce disease there by their presence, and often by their increase;

or which affect the external surface of the body either superficially, or in the deeper layers of the skin. The number of these parasitic organisms is considerable, as will be remembered when the frequent references to them in the two previous books are recalled.

IV. Zymotic Origins and Causes.

Under this head is embraced those agents material and probably organic which, acting as exciting causes, induce disease by coming into contact with persons susceptible to their influence. The diseases excited by these subtle agents are called, generally, zymotic diseases, or, sometimes, diseases from fermentation, or *zymosis*, which means the same thing. Most of the zymotic diseases, but perhaps not all, are contagious, infectious, communicable.

V. Accidental Origins and Causes.

By accidental origins or causes of disease are meant all those physical agencies which tell directly upon the body to produce mechanical or physical disturbances. These, which are commonly exciting causes, are divisible into two kinds, the *natural* and the *artificial*. Lightning stroke is a good illustration of the natural; electric shock cf the artificial variety. Amongst these causes must be placed all those connected with the industrial pursuits which lead to disease by physical or mechanical impression.

VI. Social and Psychical Origins and Causes. Habits as Causes.

Under psychical origins or causes we may include those impressions made upon the organ of the mind which lead to disturbed and unnatural mental conditions. We may take in also under this head those internal derangements which tend to the production of physical agents that tell upon the nervous organism, with the effect of causing abnormal action. We may further take in, under this same head, the influences towards disease induced by injurious habits and habitudes.

VII. Senile Degenerative Origins and Causes.

Under this last head of origins and causes we take in those final changes in the vital organs of the body which, under a

natural process of premature or mature decay or degeneration, lead to organic death, and therewith to extinction of life generally.

These senile changes may be of two kinds. (*a*) *Universal* change, when all the vital organs degenerate together,—mature decay. (*b*) *Local* change, that is to say, degenerative change occurring in one or more organs, but not in all, and leading to death through failure of a part, only, of the organism.

CHAPTER II.

CONGENITAL AND HEREDITARY, OR CONSTITUTIONAL CAUSES OF DISEASE.

DISEASES coming down to man from birth may have for their cause some peculiarity in the condition of the parents. Or, they may indicate that the parents have been placed in conditions favorable to the development of disease. Or, they may show that some accident has happened to the person born, previous to birth.

We usually speak of the causes leading to such forms of disease as of two kinds, namely, the congenital, or those with which the affected person is actually born, and the hereditary, or those which develop, as a rule, some time after birth.

The division is not very accurate, because many hereditary diseases which, as a general fact, do not appear until after a time, more or less long, from birth, may be present at the time of birth. The division, however, is sufficiently practical to admit of being retained. It is often qualified and sometimes blended, by the use of the word constitutional, which word covers both congenital and hereditary defects or proclivities.

THE CONGENITAL CLASS OF CAUSES.

Congenital Malformations.

Under the head of congenital causes we include what are designated malformations, that is to say, bad or imperfectly formed conditions either of the body altogether or of its parts or organs. The malformations represent in most cases an incomplete development or growth of parts. Sometimes this is so marked that life is impossible after birth. In other cases the malformation, less distinctive, permits life to be continued, but interferes throughout the whole of its course with the activity of its living powers. The extent to which the minor malformations act as indirect causes of

disease is not, I think, sufficiently comprehended or taken into account, for there are very few persons indeed who are free from incomplete development or growth in some parts of the body.

Malformation may take other forms. It may consist of an excessive development of some part or organ; or of an incomplete closure of the lateral halves of parts which ought to be conjoined; or of closure of lateral halves which ought to remain open; or of transpositions of different viscera or structures of the body.

All the grand systems which, combined, make up the animal system generally are liable to be subjected to derangement or disease from malformation as a cause. In the digestive system, the œsophagus, the stomach, or other portions of the intestinal tract may be constricted, impervious, or deficient. In the circulating system the heart may be imperfectly developed as a whole or in its various parts. The foramen ovale or opening which before birth exists between the right and left auricles may remain open after birth. The great vessels springing from the heart may be misplaced. The valves of the heart may be irregular or insufficiently developed. The pericardium or outer covering of the heart may be wanting. In the respiratory system one or both lungs may be deficient in development. A portion of lung may be so changed, structurally, that it never comes into full play. The trachea may be imperfect, constricted partly or altogether. The larynx my be imperfect, its vocal cords indifferently developed, or its cartilages deficient, reduced in size, irregular.

The nervous system may be the seat of various malformations, and is perhaps the system which is the most seriously affected of all. Hence the origins of numerous failures which are called general failures from disease. Various parts of the brain may be incompletely developed, or one part may be more developed, comparatively, than another. The spinal cord may be incomplete in the whole or in parts. The nervous cords issuing from the brain and spinal cord may be deficient in development, or may have an incomplete connection with their respective centres. Any of the organs of the sensory system or the parts of these organs may be insufficiently or irregularly developed.

The organs which form the glandular system suffer in like manner from malformation. The liver may be imperfectly formed or its bile-ducts may be contracted or impervious, or its gall-bladder imperfect. The kidneys may be deficient in growth, or per-

verted in growth, globulated. The ureters may be contracted. In a word, these perversions of development may occur in any of the glandular organs, and may lead to perversion of function.

The muscular system is subjected to an extensive range of irregular developments which act in producing various phenomena of disease. A muscle may be shortened in its development; it may be deficient in power when compared with the antagonistic muscle which it has to work against; it may be preternaturally large; or, its tendons may be displaced, or contracted, or imperfect. The deformities of the hand and foot, described on pp. 235–236, are often due to such malformations.

Lastly, the bony and membranous systems are liable to various malformed constructions which lead to varieties of disease. It sometimes happens that the lateral halves of the bony system that should come together fail to do so. This is the case in the disease known as spina bifida, described at p. 176, in which the membranes of the spinal cord protrude through a cleft in the spinal column. In the membranous system a similar absence of union is observed in instances of harelip and cleft palate, the irregularity of membranous and bony development being coincident.

It will be seen from this brief survey how very important a part even minor malformations may play as causes of disease. It may be accepted, that very slight malformations interfere with the functional activity of the portion of the body affected by them. In fact, many of the particular failures of special organs or parts of particular persons, and many deaths from disease of special organs of particular persons are determined by the malformation or imperfect development with which the organ was affected from the first of its life.

Congenital Derangements as Causes.

Apart from malformations there are certain derangements incidental to the intra-uterine life which act afterwards as causes of disease. I made this subject a matter of special study in my "Fothergillian Essay" on the diseases of the child before birth, and described these perversions or derangements in a synopsis of which I may here give another synopsis.

I found that by simple perversion of the nutritive processes there might be induced the following structural changes:

1. Hypertrophy, or enlargement of vital muscular organs, such as the heart and bladder.

2. Atrophy, or wasting of vital structures, which may be general, that is to say, affecting the whole body; or local, affecting particular organs, such as the heart, liver, or kidney.

3. Complete arrest of nutrition, general or local, attended in some cases with complete decomposition of an organ.

4. Inflammations, including inflammation of the membranes of the body; of the skin; the mucous membrane of the lungs and of the intestinal tract; of the serous membranes, pleural, pericardial, peritoneal. Or, inflammation affecting the structures of organs, the lungs, the kidney and other glands, the brain. The results of these inflammatory changes seem to be the same when the disease precedes as when it appears subsequent to birth, the formation of matter, the process of ulceration and the other secondary changes being the same.

5. Exudations, sometimes of blood itself, into various parts or organs, and specially into the substance of the brain or the substance of the lungs; or exudations of some parts of the blood, as the serum, into the different cavities. These exudations lead to all the known varieties of dropsy and accumulations of fluids.

6. Communicable diseases, including syphilis, small-pox, vaccinia, measles, scarlet fever and typhus, all running apparently their own peculiar course, and leaving their distinctive results.

7. Transformations, malignant, tubercular, and rickety; including different kinds of malignant tumor or cancer affecting various organs; deposits of tubercle; and, softened and brittle conditions of the bones.

8. Parasitic developments, occurring in the form of hydatids affecting the kidney, or entozoa affecting the alimentary canal.

9. Inorganic products, or deposits, present in the cavities of the body, as in the form of calculus of the bladder; or on the skin in the form of colored, reddish, hard deposit or firm scaly crust,—*ichthyosis.*

10. Mechanical alterations and injuries affecting (*a*) the vascular system in form of aneurism; (*b*) the skin in form of wound; (*c*) the bones in form of fracture and fixation of joints,—*anchylosis.*

11. Derangements of the muscular system, including convul-

sive movements and a form of persistent contraction of muscles, rendering the body generally rigid.

12. Accidental separation of parts, or amputations of the fingers or limbs, induced by pressure or by strangulation of the parts from plastic exudation or other accidental constricting substance.

From this epitome, brief as it is, of the subject now in hand, the reader will learn how serious a part is performed by the derangements which occur antecedent to birth, and how effectively such derangements may become causes of disease after birth. It is true that in the greater number of the instances cited in the above twelve headings there was sufficient disease to render life impossible from the first. They call our attention, however, to certain other instances in which there has been no acute progress towards death, but in which a sufficient degree of mischief has been inflicted to leave a permanent impression on the whole of the life of the affected individual.

The Hereditary Class of Causes.

The hereditary class of causes, as distinct from the congenital, have usually, as we have seen, this peculiarity, that the inherited disease is not necessarily present, and indeed is not often present until after, it may be many years after, birth. The distinguishing mark of the hereditary cause is that it lies, as it were, dormant, ready to show its effects if aided by an external co-operating cause.

Constitutional taint may therefore show its influence in two directions, namely, in the tendency to, and in the development of, disease. The taint may be of such a kind that the disease it favors will not actually occur until some active external agency is brought to excite it. Or, the taint may lead to the development of the disease without any such extra and exciting influence.

Thus the hereditary affection, although born with the birth, is often not displayed until a long time afterwards. But, sometimes it is displayed at the moment of birth.

At the threshold of this subject a question arises which is of immense moment; I mean the question how the many taints, which are undoubtedly hereditary, commence. It is difficult enough to discover how they, as causes of disease, pass on from

one person to another in parental line. It is infinitely more difficult to trace the origin of the taints themselves. That they must all have had an origin from without seems to be certain, and our most modern experience goes to show that the outside origination of them is still in progression, for we have seen that in cases of lead poisoning in the male an impression may be made that is transmissible to the children of the affected. This is, perhaps, the most definite observation that has been recorded ; but it is almost equally clear that persons who have acquired phthisis pulmonalis by working in dusts, have also acquired the power of transmitting the same disease to their offspring.

The results of all the inquiries which I have been able to institute have led me to the conclusion that in cases of hereditary disease the impression which has been made upon the affected person, and which is transmitted to the offspring, is inflicted primarily on the nervous centres. This view is contrary to the common belief which fixes the taint in the blood, and which is expressed in such every-day terms as "bad blood, good blood, impure blood, ancestral blood, family blood, diseases which run in the blood," and similar terms, terms which are applied as freely to mental as to physical proclivities.

The view which assigns the seat of the taint to the nervous matter rather than to the circulating blood is most in accord with modern observation. The blood is a fluid undergoing constant change, and could not be a seat of any permanent taint. The nervous structure, on the other hand, is, comparatively, subjected to little change, and is, as we know, the seat of transmitted mental tendencies. Moreover, we have learned by direct experiment that physical nervous injuries inflicted on parents are transmitted to offspring. Epilepsy induced by nervous injury has been transmitted in hereditary course.

In what manner the primary injury passes from the parent to the offspring, and that in the paternal as well as the maternal line, is not known ; but the fact is certain. There is also one other fact which bears upon the subject with great force. It is observable that the injuries to nervous matter which are capable of producing hereditary diseases must be inflicted either on a nervous centre or on a trunk of a nerve. Injuries inflicted on the extremities of nerves do not seem to be followed by changes that are permanent and transmissible. For ages past the Jews by the

act of circumcision have inflicted a peripheral wound or injury on all their male children, but they have never implanted thereby a transmitted change. It is not until the motion of a part directed by central nervous control, or the nutrition of a part directed by central nervous control, or the motion and the nutrition are perverted by a central injury, that the inherited mischief is established.

Hereditary Special Taints.

The number of hereditary taints of disease are so large that the mind is inclined, almost, to accept that every definable disease is hereditary with more or less of directness and intensity. The following are the most generally accepted of the hereditary taints of disease, called, commonly, constitutional peculiarities, or diatheses.

The Syphilitic Taint.

The taint of the disease known as syphilis, described at pp. 56–7 of this volume, is transmissible by heredity, and is the cause in the descendants of those affected by it of the constitutional effects of the disease. This is one of the most patent facts in the whole field of medicine. The effects of the taint may be manifested at birth; they may be developed months after birth. They may be developed in infancy or early life, if they are called forth; some shock or illness, slight as vaccination itself, inducing them in the fullest degree. They may appear as late as the time of adolescence or later. The phenomena produced by the taint and depending upon it for their cause are, in a considerable number of instances, the phenomena of the disease itself, pure and simple, in what is known as the chronic form, the equivalent to the tertiary form in a person primarily affected. But in other and in a very large number of instances the pure and simple outlines of the affection are lost, and other affections, or conditions of disease, take, *nominally*, their place.

There is the widest difference of opinion amongst even the most laborious and learned of the Faculty of Medicine respecting the extent to which the action of the taint of syphilis, as the hereditary cause of various diseases known under other names, extends. Unquestionably the extension is very wide, and I fear that those who have given to it the fullest range have been nearest to the truth.

All the great systems of the body seem to be included in the mischiefs that may be transmitted by this hereditary cause of disease. Feebleness of digestion and various kinds of dyspepsia, are common as signs of transmitted syphilitic action. The disturbance of the alimentary system and diarrhœa, which are so fatal in some young children, in spite of careful feeding and nursing, are often due, primarily, to this cause. The heart and organs of the circulation are seriously changed by this taint in regard both to their organic development, their construction, and their function. The heart is rendered feeble in its action, and the vessels are prone to take on degenerative changes. The breathing organs are distinctly susceptible to injury from this hereditary cause, and one specific form of pulmonary phthisis,—*syphilitic phthisis*,—has been attributed to it.

The nervous system is perhaps of all others the most impressed by this transmitted influence. Epilepsy; chorea, or St. Vitus' dance; other forms of convulsive disease; and, paralyses of various kinds have been traced, by Dr. Hughlings Jackson, to inherited structural tendencies springing from syphilis. I have, for my part, become so familiar, in practice, with the fact of the connection of inherited syphilis with the wide field of nervous disease, that I never see a case of the kind now without making an inquiry as to the hereditary history. The sensory organs, the organs of sight and hearing particularly, are subjected to disease from the same taint. Many of the most ordinary born failures of sight and hearing are also derived from an imperfect development, resting on an imperfect nutrition, the syphilitic constitution being the foundation of the imperfection.

The four other great systems of the body,—the glandular, the muscular, the osseous, and the membranous,—come in like manner under this malicious taint. The bony structures are often, most significantly, the parts so affected. Mr. Jonathan Hutchinson, whose admirable labors on heredity in disease cannot be overpraised, has described, from the teeth, an absolute test of syphilitic taint. This consists of a marked diversion from the natural shape of the two central incisor teeth of the permanent set of the upper jaw. These two teeth in their natural state are chisel-shaped and broader at their cutting edges than at their insertions into the gum. But in persons of syphilitic taint they are narrower at their cutting edges than at their insertions into

the gum, and they are usually notched. When such teeth are present other signs of feebleness of the bones, or of deformity, are commonly present also, the cause being the same.

Disease of the membranous surfaces of the body from the taint of syphilis is almost as common as disease of the nervous structure, and indeed the two conditions are so closely connected, it is, on many occasions, difficult to distinguish which has precedence, the membranous affection seeming to be closely connected with nervous failure. All the membranous surfaces are susceptible to injury from the taint, but the skin is the most frequent seat of mischief. The skin, under this influence, becomes easily affected with psoriasis,—lepra vulgaris,—with rupia, alopecia, eczema, and, perhaps, pityriasis.

It will be seen from the above how intense a taint is this first of the hereditary causes of diseases on our list; and I have but glanced at the subject. It is of common observation amongst us medical men that the symptoms implanted on the constitutional disease are so varied and so extensive we do not really know how far they extend. Dr. Hughlings Jackson says on this point, most correctly, that it is only by studying a longer "base line" that we can discover how widely different symptoms arise out of the one degraded bodily state which the offspring of syphilitic parents present. "Whilst," he adds, "the eldest child of a family may show external signs of syphilis, such as nebulous cornea, scars about the mouth, or loss of the uvula, the rest of the family may be undamaged externally, and yet be ready to suffer in more obscure ways from a smaller share in their sad common inheritance. It would seem, in acquired syphilis at least, that the symptoms are directly due to a fault beginning in a common tissue, the connective, and the wide distribution of this tissue shows how we may have very different symptoms from its failure in organs or parts of high or of low function."

This is admirably spoken, and carries with it all that I have space to say on syphilis as a cause of disease, except one more observation; namely, that the cause acts, unhappily, through more than a single generation. I regret to add, that I have seen it operating certainly through three, and, possibly, through four generations. On the person primarily affected, the effects, in the opinion of Professor Gross, never die out. With this I more than agree, for I am inclined to supplement that view by saying that

the effects in the members of the first succeeding generation never die out.

The Scrofulous and Tuberculous Taint.

The condition of disease called scrofula, or struma, is connected with a taint of a definite kind. There are, as will be seen on p. 63, two varieties of scrofula; viz., scrofula with tubercle, and scrofula without tubercle. In both cases the taint is present, and those born with it are the victims of scrofulous or tubercular disease. Whether there are two distinct taints, or whether there is but one taint, which tends to produce differing phenomena of disease under the differing circumstances to which the person who is subject to the influence of the taint may be exposed, is a question of the extremest difficulty to answer.

I have made many careful analyses of facts bearing on the point, but am still unsettled in my mind as to the solution of the difficulty. I have seen many become consumptive who have never shown symptoms of scrofula in the way of scrofulous tumor or glandular enlargement of any kind, their parents or close relations being of consumptive tendency. I have seen scrofulous persons escape tubercular consumption.

But, again, I have seen in a scrofulous family, derived from scrofulous parents, certain members affected by scrofula, others by consumption; and, I have often seen those who were scrofulous become consumptive.

Thus the evidence is peculiarly complex, if not contradictory. The only conclusion we can draw from it is that the taint, in passing hereditarily from one person to another, may, under varying states of an external kind which act upon it, undergo changes which modify its ultimate effect.

There is a view now gaining ground to the effect that the scrofulous taint is a variety of the syphilitic. This view is strongly enforced by my friend, Professor Gross. "The word scrofula," he says, "for centuries past in such common use, has, it is well known, a special import with respect to the deformed condition of the neck, assimilating it to that of a swine. At the present day the affections included under this denomination amount to upwards of twenty. Among the more common are chronic enlargements of the lymphatic glands, various eruptions and ulcerations of the skin, embracing the milder forms of lupus, chronic

abscesses, especially psoas and lumbar, Potts' disease of the spine, psorophthalmia, chronic tonsillitis, caries and necrosis, ozœna, strumous inflammation of the eyes, strumous hip-joint disease and white swelling, malignant onychia, otorrhœa, rickets, arachnitis, hydrocephalus, pemphigus, sycosis, keratitis, and the notched and irregular condition of the teeth of infants and children, so ably discussed by Mr. Hutchinson."

These facts lead this learned author to assume that "scrofula is generally, if not uniformly, merely a transformation, a degeneration, or a remote effect of the syphilitic virus. Through how many generations scrofula may retain its specific powers, we have, he thinks, no means of determining; but children of consumptive parents are almost invariably scrofulous, and the taint thus engendered runs through several generations, uprooting not unfrequently entire families. On the other hand, it sometimes skips a generation, and reappears in the next succeeding one, just as family likenesses sometimes do. Still it is scrofula." To these views I should myself give entire assent.

The hereditary taint of pulmonary consumption is so intensely marked, that out of three thousand instances of the disease which have been before me for treatment, in general and public practice, I have not found it absent in so many as ten per cent. when all cases presenting any real doubt were excluded.

Malignant or Cancer Taint.

All the varieties of malignant disease or cancer defined on p. 61 are connected with the constitutional taint. This is, I believe, as true in respect to one variety as to another. In every inquiry which I have been able to make, in public practice, in private practice, and in what I may call insurance practice,—I mean the selection of lives for insurance,—I have never met with one example of the disease, cancer, in a person suffering from it without finding some pre-example of the same affection in one or other member of the family. The disease occasionally skips a generation, but it is nearly always to be found as hereditary.

The malignant taint appears, according to our present knowledge of it, to be specific. One variety is not, however, always produced by transmitted taint of the same variety. I have known scirrhus, or hard cancer, in the parent, followed by the same in the next generation; but I have as often known scirrhus in one

generation followed by epithelial, or by medullary, cancer in another, and *vice versâ*. It is probable, therefore, that the virus or taint is the same, but that it is capable of some modification, under which it leads to a different variety of the disease in different subjects.

What the nature of the cancer taint is we cannot say. What the structure is in which the taint is impressed or implanted we cannot say. I have ventured to think, from various studies of the question, which I must not enter on here, that the nervous system is the primary seat of the impressed evil. This, however, is mainly speculative, and must be accepted as nothing more. The taint, whatever it may be, does not give evidence of its presence, except in rare examples, until after adolescence, and it often waits for some exciting injury or shock to call it into action.

Rheumatic and Gouty Taints.

The rheumatic and gouty diseases have an unquestionable basis in morbid impression or taint, derived from parentage. These affections, at the same time, must be considered as differing in two particulars from some that have been named before; firstly, that they more frequently than the others seem to spring up without pre-existing taint; and, secondly, that the impression or taint which they transmit is less persistent. I believe that, in two generations, these diseases lose their taint, although the taint is often very severe in the second generation affected from the primary source. I knew one instance in which a woman, who had no traceable rheumatic history, became affected with rheumatic fever from living and sleeping in a damp, newly-built house, and who afterwards gave birth to seven children, every one of whom inherited her acquired disease. In like manner I have seen gout transmitted, by heredity, from a parent who, as far as evidence of his past family history could be trusted, had himself acquired the affection by his own luxurious mode of life.

How the tendency to these diseases is passed on we have as yet no clue. Whether something material and active is passed on from one generation to another; or whether it is a purely physical impression, or vibration, which is transmitted, we cannot pretend to say. For the moment we must accept the fact of the transmission and wait for its explanation.

Nervous Impressional Taints.

So many nervous impressional taints, indicated by aberration or failure of function of the nervous system, are passed from one generation to another, it would almost be to go through the history of all the nervous diseases to record them. I will name those which are most striking.

Epilepsy is one of the transmitted affections, though whether it should be considered, when so transmitted, as a distinct disease or as the symptom of another disease, like syphilis, remains an open question. Chorea admits of being placed under the same description. The various forms of palsy or paralysis are often connected with an inducing tendency or taint; and it is probable that apoplexy would come into the same position. All the emotional and mental derangements and diseases are, or may be, connected with the inherited tendency or taint. Hysteria is often so connected; melancholia is often so connected; hypochondriasis is often so connected. Insanity and that development of mental deficiency called idiotcy are, as a general rule, dependent on a taint. The taint in the matter of insanity is as definite as the taints of cancer, scrofula, or syphilis; it may skip more than one generation, and then appear in as distinct a form as it presented in the early family representative of it. A form of purpura dependent upon deficient nervous control over the minute circulation is another phase of nervous failure clearly connected with hereditary susceptibility or taint, and exercising an influence passing through two, if not more, generations.

Alcoholic Taint.

Intemperance acquired by those who indulge in alcoholic drinks sets up a tendency or taint which may pass from one generation to another. I think it is possible that more has been made of this inherited evil than the facts wich bear upon it, carefully collated and studied, justify. I am quite sure from direct observation that there is an inherited alcoholic intemperance, for I have, unfortunately, been obliged to witness it too often to be in any doubt about it. At the same time there are here so many ways in which we may be deceived in observation; there is so much in those affected that might have been directly acquired by mere imitation; and there are so many intemperate

people who attach their own folly and weakness and vice to the curse of inheritance, it is impossible to be too circumspect in arriving at a conclusion.

Of all the taints derived from parentage or ancestry the alcoholic is probably the least permanent. Unless the habit it engenders be kept up, I believe that the worst taint is removable in two generations. It is often removable in one, and I doubt whether a strong taint may not be kept under control in a second generation, when the circumstances for self-restraint are favorable.

Zymotic Taint.

We have seen that one disease, essentially a contagious disease, syphilis, is often developed by the communication of a taint in the hereditary line. It is a sound inference from this fact that other contagious diseases may be connected with a similar favoring agency. The evidence is not so clear in respect to the general run of contagious maladies, as it is to syphilis, that they are hereditary; and yet it is fairly demonstrative to this effect. Typhoid and diphtheria are, I consider, well proved instances of diseases which have an hereditary history. Scarlet fever, by a negative proof, shows a similar position, for I have known a family the members of which, though exposed to the poison of scarlet fever in the fullest degree, have shown an insusceptibility to suffer from it. Small-pox has, in all probability, a strong tendency to pass by inheritance, and at one time, when inoculation for it was general, it must have been an almost universal inheritance of the direst kind.

Mixed Taints of Disease.

In studying the constitutional or hereditary causes of diseases we have finally to consider the fact of mixed types of such causes. It happens in certain families that the hereditary taint is so strongly developed in one direction that the single taint overshadows or covers all the rest. In other instances a taint derived from one branch or side of a family is commingled with a taint derived from a different branch or side of the same family. There is then established what I have described as the intermarriage of disease, a subject the importance of which impresses me more and more deeply as my professional life advances.

The worst combinations of types are those where the taints

of extremely fatal diseases are represented. The combination of the taint of cancer with that of consumption is a striking case in point. Under such combination one form of taint will be manifested in some members of a degenerated family ; the other form in other members ; while certain of them may present what seems to be a mixed type of tainted organization. Thus I have seen following an intermarriage of disease of the kind named, cancer in one member of the tainted family, tubercular disease of the lungs in another, and that form of doubtful cancerous disease, called *lupus*, probably a mixture or cross between cancer and scrofula, in a third.

Combinations of rheumatic and gouty taints with consumptive lead to another class of intermediate diseases in which the bony framework of the body is easily implicated. That peculiar disease of the hip-joint described at page 243 as *morbus coxæ*, is, I think, due to the admixture of the rheumatic with the scrofulous taint. Hydrocephalus is probably another illustration of the same combination. The diseases of bone called rickets and mollities ossium, described at pages 241–2, are due, I believe, to a combination of the scrofulous and syphilitic taints.

Racial Heredities.

With the whole of this question of hereditary transmission of disease is blended the much wider question of race and disease. The value of life in different races is very different. In this country the Semitic race presents a vitality which is much more favorable than that belonging to either the Saxon or the Keltic races. This is the fact through all the ages of life. It is also true that the different races exhibit special immunities and special proclivities to disease. The Saxon people show an unusual tendency to scrofula and consumption, and to diseases allied to these in character. The Keltic people are, according to my observation, more liable than either of the other races to acute affections of the brain and nervous system. The Jewish or Semitic people are subject to one hereditary disease, cancer, quite as determinately, I believe, as the Saxon and Keltic, and they are also subject to melancholia; but they are less subject to the acute nervous diseases, to suicide, to the tubercular class of maladies, and to the contagious or infectious group of fatal affections.

From epidemics the Jews have often escaped, as if they possessed a charmed life.

These tendencies for and against particular diseases and classes of diseases are no doubt hereditary. How far they are due, in the first instance, to habit and mode of life; how far they depend upon some particular power or faculty impressed primitively on the race, it is perhaps impossible to explain and, perhaps, dangerous to submit to speculation. I shall therefore only venture to express that acquired and transmitted qualities, and specific existing social peculiarities, are sufficient agencies for the production of all the known variations of disease belonging to particular races.

CHAPTER III.

ATMOSPHERICAL, METEOROLOGICAL, AND CLIMATIC CAUSES OF DISEASE.

It is one of the commonest as well as one of the oldest observations, that some diseases affecting the bodies of men and animals are due to atmospherical conditions, and to climatic changes. We attribute, usually, the contraction of colds or catarrhs to peculiarities in the wind or weather, and it has been customary to connect the great epidemics with atmospheric peculiarities.

The older physicians seem to have attributed all pestilential diseases to the atmosphere. Sydenham considered that small-pox itself arose from some unknown particles of the atmosphere unconnected with contagion, and this view was largely maintained until the early part of the present century. Dr. John Adams, in his essay entitled "An Inquiry into the Laws of Epidemics," was, I believe, the first to distinctly refute this impression, and to put the matter in its true light. Without disputing that atmospheric changes may be causes of disease, Adams laid down a rule, which was exceedingly precise and correct, namely, that "nothing can be called a contagion unless the person affected by it can induce a similar disease in others without regard to season, climate, or any local circumstances."

This was an important enunciation, because it separated the ideas of the air itself as a cause of disease from the air as a mere carrier or bearer of contagion.

We start then in this chapter with the fact clear in our minds, that the diseases truly of atmospherical origin are not diseases dependent upon contagious matter borne by the atmosphere, because the purest and best atmosphere, as Adams says, may be such bearer. We have to consider the atmosphere itself as a cause of disease.

It is necessary at the same time to understand that while at-

mospheric changes may not be the immediate cause of diseases of the contagious type, they may very considerably influence the effects of the true causes of those diseases, and this specially in regard to the mortality induced by the diseases. Here we are brought into contact with what we may call the secondary action of the atmosphere in respect to causation. It is also necessary to bear in mind that the border line between the class of diseases springing directly from atmospherical causes and the class springing from contagion is often very refined, and that it is possible that some diseases which are induced by atmospherical variations may pass into the diseases which are communicable by contagion. Common cold, or catarrh, is one of these diseases on the border line. That common cold is sometimes communicable from one person to another is an hypothesis based on repeated observation; and that from common colds other diseases, more distinctly contagious, such as influenza, may arise, is a theory resting on a good basis of fact.

It might be advisable for the sake of a rigidly systematic description to divide the subject now before us into two parts; the first dealing with the direct and positive effects of atmospherical variation in producing disease; the second treating on the indirect or secondary effects of the atmosphere in modifying the intensity, course, and results of affections produced, primarily, by another agent. On the whole it will be best, and least confusing, to avoid such division, and briefly to present what can be said respecting atmospheric causes of disease in their secondary as well as their primary character.

For the proper arrangement of this study it will be necessary for me to consider the general effects of season in relation to disease and mortality. Afterwards I shall have to take up certain details relating to atmospheric temperature and moisture, atmospheric pressure, electrical conditions of the air, the influence of particular winds, and some climatic variations in reference to disease and its terrestrial distribution.

Before, however, I touch on these topics two preliminary statements of facts deserve attention. The first relates to what may be called the physiological changes effected on healthy people at different seasons. The second bears upon some peculiar physical conditions of the air itself, and of life under such conditions.

Influence of Seasons on Healthy Persons.

The facts bearing upon the influence of seasonal changes on persons in health to which I would first refer, were recorded by the late Mr. Milner of Wakefield.

From his position as surgeon to the convict establishment at Wakefield, Mr. Milner was enabled to weigh every prisoner at given periods, to compare the gain and loss throughout the year, and to estimate such gain and such loss, by individual against individual, and by diet against weight. The prisoners upon whom the observations were made had been sent to Wakefield to undergo the first portion of their punishment. They were kept in separate cells for a period of nine months; they were all males between the ages of fifteen and sixty, and they were all in good health when they arrived. Their cells having an equal capacity and the same means of ventilation, they were served with the same quantity and character of air, and the mean temperature of the cells was in every case 61°. The men were all fed on the same kinds of food, they were all dressed in the same attire, and they were made to take the same amount of exercise. They were weighed on admission, and again at the latter end of every calendar month during their stay. The number of men weighed exceeded 4,000; the period occupied in observation was ten years; the average number of prisoners weighed monthly was 372; and the total number of individual weighings was 44,004.

With the first months of the year, Milner found that the body undergoes an average loss of weight in January, February, and March, the proportion of loss being 0.14 in January, 0.24 in February, and 0.95 in March. During the months of April, May, June, July, and August, there is gain in the following proportions: for April, 0.03; for May, 0.01; for June, 0.52; for July, 0.08; for August, 0.70. In September, October, and December, there is a loss in proportion of 0.21 for September, 0.10 for October, and 0.03 for December. November presents an exception to the months that precede and follow it, there being an average gain of 0.004; so that, at first sight, November would seem to be an exception, in a very slight degree, in the losing series of months that precede and follow it. But Mr. Milner points out that this apparent exception was caused in the prisoners by the arrival of large numbers of men each year, and by the fact that the men

usually gain weight for a short time after they are received; so that this break in the series results from the influence of the stage of imprisonment. On the whole, there is an average loss beginning in December, and increasing rapidly up to March. In April there is an abrupt gain, which extends irregularly until August. In September there is a rapid loss, which continues less rapidly through October.

From these facts Mr. Milner drew the following important inferences: 1. The body becomes heavier during the summer months, and the gain varies in an increasing ratio. 2. The body becomes lighter during the winter months, and the loss varies in an increasing ratio. 3. The changes from gain to loss, and the reverse, are abrupt, and take place about the end of March and the beginning of September.

Influence of the Air under Peculiar Physical Conditions.

The second point to which I would draw attention has reference to some changes which take place in the air itself, and which affect life independently of what are commonly called changes of weather or season. At the meeting of the British Association for the Advancement of Science, held at Oxford in 1860, I narrated a series of researches which had been carried on then for ten years, in order to determine the effects of oxygen on animal life, and which had led me to discover the following facts:

(1) That if the life of warm-blooded animals is supported on pure oxygen at the temperature of 75° Fahr., the gas produces a quickened combustion of the body, *hypercausis*, or increased burning.

(2) That in order for this condition to be maintained, it is necessary that the oxygen should be freshly made, and steadily supplied in current.

(3) That if this be not done, the oxygen soon begins to fail to support proper vital action, however carefully the products of respiration are removed; the animals inhaling it become drowsy and fall into gentle but complete sleep which ends in death if the inhalation be continued.

(4) That this rule applies to all warm-blooded animals, but that cold bloods, like frogs, are unaffected.

From these observations I drew the following conclusion:

Oxygen when breathed over and over again, although freed

entirely from carbonic acid, or other known product of respiration, loses its power of supporting the life of warm-blooded animals; the process of life ceasing, not from the introduction of a poison, but as by a negation or a withdrawal of some principle extant in the primitive oxygen which is essential to life.

In a later series of researches I found that in this negative condition of oxygen, the decomposition of dead animal substances is very much accelerated.

To air thus changed or deteriorated I gave the name of *devitalized* air, and I believe it to apply to conditions in which the air is deteriorated by the presence of organic matter, as in close rooms, crowded cities, and sometimes even in open situations in particular localities noted for closeness and oppression of the atmosphere.

Still further, on the same line of investigation, I found that by submitting the negative or devitalized oxygen to the electric spark it resumed its activity, and I was thus led, in conjunction with the late Dr. Thomas Wood, to test the action of electrified oxygen, or ozone, on animal life. In these experiments a different series of results were brought out. We found that the air of the laboratory in which we worked produced decisive effects upon ourselves, namely, headache of an intense kind, a disagreeable pricking sensation of the nostrils, a severe catarrh attended with copious discharge from the nose, and ultimately quickened and difficult respiration. These symptoms were so definite we felt it necessary each time before we began to produce ozone in large quantities, to diffuse the vapor of ammonia through the air to neutralize the action.

Before the conclusion of our research, which ended in 1864, we discovered that in warm-blooded animals the effects of ozone were the same as upon ourselves, and that the continued inhalation of ozone by them led to congestion of the lungs, rapid coagulation of the blood, and death in a brief period, often in the course of an hour, if warmth, which greatly accelerated the action, were added. At a temperature of 40° to 45° Fahr. a warm-blooded animal would live, without being seriously affected, for many hours in air charged as fully as it could be with ozone; while at 70° Fahr. the action commenced immediately, and led to fatal results within the hour.

We learn from these data that there are two differing conditions of oxygen, one active, the other negative; and as either of these conditions may, according to Schönbien, be present at different times in the atmosphere, the effects incident to their presence require to be borne in mind in the chapters which immediately follow.

CHAPTER IV.

ON WEATHER AND SEASON AS CAUSES OF DISEASE.

THE distinguished Arbuthnot was of opinion that every season has its special diseases, a view which he supported most ably, and which, as the facts about to be stated will show, is sustained in a remarkable degree by modern investigation.

The prevalence of diseases as a whole, and of the mortality arising from them, is well-marked in various periods of the year. In 1853 I made a careful analysis of the facts bearing on this subject, and obtained very important results. The analysis referred only to the diseases of certain parts of England, and was derived from mortality tables, viz., those published by the Registrar-General; but from its wide basis, its results gave a fair picture of the special season diseases of England.

The analysis included deductions made from not fewer than 139,318 deaths, occurring during years extending from 1838 to 1853, and arising from the following diseases: small-pox, measles, scarlet fever, whooping-cough, croup, diarrhœa, dysentery, cholera, influenza, ague, remittent fever, typhus, erysipelas, quinsy, bronchitis, jaundice, and carbuncle. The districts of death were London, Devon, and Cornwall.

Out of 139,318 cases thus chronicled, as occurring from the above-named diseases, and estimating the gross mortality according to the season, without reference to particular years, the percentage of mortality in the different quarters ran as follows: In January, February, and March, 25 per cent.; in April, May, and June, 21 per cent.; in July, August, and September, 24 per cent.; in October, November, and December, 28 per cent.

Having learned thus much, I set about ascertaining, on the same large scale, whether the fatal diseases were in any way special to the seasons. The answer to the inquiry was to this effect:

Whooping-cough, croup, small-pox, and bronchitis were most common in the first quarter.

	1st Quar.	2d Quar.	3d Quar.	4th Quar.
Small-pox	27,352	24,551	22,824	25,272
Whooping-cough	32,704	27,825	17,116	22,354
Croup	27,523	25,100	19,919	27,456
Bronchitis	36,793	20,301	10,327	32,570

Pneumonia, I believe, might very properly have been added here.

In the second quarter quinsy only stood ahead. Thus:

	1st Quar.	2d Quar.	3d Quar.	4th Quar.
Quinsy	21,762	30,596	21,231	26,410

In the third quarter diarrhœa, dysentery, and jaundice took the lead.

	1st Quar.	2d Quar.	3d Quar.	4th Quar.
Diarrhœa	10,196	10,717	58,519	20,567
Dysentery	15,638	13,541	42,460	28,340
Jaundice	24,877	24,030	26,967	24,109

In this third quarter, Asiatic cholera, when epidemic, assumes a greater mortality and prevalence than at any other season.

In the fourth quarter influenza, ague, remittent fever, typhus, scarlet fever, measles, erysipelas, and carbuncle took the lead.

	1st Quar.	2d Quar.	3d Quar.	4th Quar.
Influenza	23,539	12,171	4,502	59,784
Ague	22,857	24,285	20,000	32,851
Remittent Fever	23,077	26,315	23,481	27,125
Typhus	25,741	24,825	22,912	26.521
Scarlet Fever	20,809	18,978	26,234	33,976
Measles	19,864	21,466	26,234	32,434
Erysipelas	25,144	23,444	22,337	29,174
Carbuncle	26,771	19,685	24,409	29,133

In a pathological as well as a statistical point of view, these results are most interesting; for they prove, in a great measure, that diseases, analogous in their general characters, group themselves singularly together at special periods. Thus we see that,

in the autumn quarter, there are grouped together those diseases which have for one of their essential symptoms an exudation from the intestinal surface, or from that large abdominal organ, the liver. In the first quarter, the diseases of the respiratory system —croup, whooping-cough, and bronchitis—stand forth prominently, while in the fourth quarter, a large family of diseases of the febrile or inflammatory order take the first position.

It is not by mere accident that these divisions occur; they are the effects of fixed, though nearly unknown, physical or chemical laws.

It is worthy of special remark that the fourth quarter of the year is that in which the number of diseases causing a prominent mortality is, as a general rule, greatest, and that next to it is the quarter commencing with the new year. As the cold of winter more decidedly sets in we begin to see developed, almost of necessity, an increase of deaths from pulmonary diseases, and of low fever amongst the poor, if provisions become high in price and insufficient in quantity or quality.

In public practice, it is almost always to be observed that diarrhœa is a common symptom amongst the poor during intensely cold weather. In this form it does not, however, prove very fatal; and hence it stands low at that time in the mortality returns. It seems to occur simply from internal congestion, arising from long exposure of the external surface to the cold.

The views above expressed were published in my paper on "Season in Relation to Disease" in the "Journal of Public Health" for December, 1855, pages 366–9. They have been generally sustained by other writers.

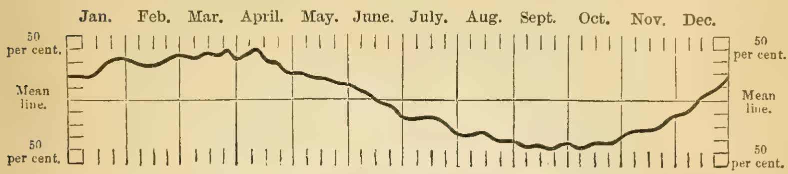
Recently the learned officials of the Scottish Meteorological Society, Mr. Buchan and Dr. Mitchell, have, in the most elaborate and laborious manner, illustrated this subject by an analysis of mortality returns of London from 1845 to 1874, a period of thirty years; and those of New York from 1871 to 1877.

The work of these authors is so important I feel it necessary to offer a summary of the facts which they have supplied.

I should premise by stating that the results of their examination of the data before them is expressed throughout by a curve on a mean line. I give one illustration, from their calculation of the mortality of whooping-cough, as a representative of all the others.

CURVE OF MORTALITY FROM WHOOPING-COUGH FOR ALL AGES AND BOTH SEXES.

Derived from Calculations of 34 *Years.*



A glance at the above will show that the height of the curve above the line, and the depth of it below the line indicate the periods of maximum and minimum mortalities from the respective diseases.

The facts thus collected are summarized in the subjoined extracts, in which I have only departed from the authors' plan in the matter of the arrangement of the diseases, in order to maintain the system of arrangement which has been carried on throughout this volume.

Abstract on the Influence of Weather on Mortality from Different Diseases and at Different Ages in London and at New York. By Alexander Buchan, F.R.S.E., and Arthur Mitchell, M.D., LL.D., F.R.S.E.

[From the "Journals of the Scottish Meteorological Society," 1875–8.]

PERIODS OF MORTALITY IN VARIOUS CONDITIONS OF DISEASE.

Irritation. Teething.

London.—Maximum.—January to middle of June and end of July; absolute, March, April.
Minimum.—Middle of June to end of December, with exception of last week in July; absolute, October, November.

Dropsy.

London.—Maximum.—November to April; absolute, February, March.
Minimum.—June to October; absolute, July, August.

Atrophy.

London.—Maximum.—July to September; absolute, August.
Minimum.—October to end of June; absolute, May, June.
Curve is allied to that for tabes mesenterica and bowel disease.

Mortification.

London.—Maximum.—Beginning of December to beginning of May; absolute, March, April.

Minimum.—June to beginning of December; absolute, August and September.

Senile Decay; Old Age.

London.—Maximum.—Close of November to end of April; absolute, January.

Minimum.—May to close of November; absolute, July to October.

Very rapid rise in this curve in November.

PERIODS OF MORTALITY IN DISEASES RUNNING A DEFINITE COURSE IN BOTH SEXES AND ALL AGES.

London and New York.

Small-pox.

London.—Maximum.—Last week of May.

Minimum.—Last week of September.

Above the average from Christmas to end of June.

New York.—Maximum.—May.

Minimum.—September.

Above the average from January to July.

Measles.

London.—Maximum.—Larger, November, December, January; smaller, May and June.

Minimum.—Larger, August, September, October; smaller, February, March.

New York.—Maximum.—Larger, July; smaller, February.

Minimum.—Larger, September; smaller, April.

Scarlet Fever.

London.—Maximum.—September to end of year.

Minimum.—February to end of July.

Highest death-rate through October and November.

New York.—Maximum.—December to June; absolute, April.

Minimum.—July to November; absolute, September.

Typhus.

London.—Maximum.—January to beginning of May.

Minimum.—Middle of May to end of September. Except hot season of July and beginning of August typhus is below average from middle of May to end of September.

Typhoid Fever.

London.—Maximum.—October and November.
Minimum.—Middle of May to end of June.
Falls below average last week of February; begins to rise gradually in July.

New York.—Maximum.—August to November; absolute, September.
Minimum.—Nearly equal over other months of the year.

Remittent Fever.

London.—Maximum.—Larger, April to June; smaller, middle of December.
Minimum.—September.

Diarrhœa.

London.—Maximum.—Middle of July to beginning of August.
Minimum.—Absolute, March and April.
Maximum commences slowly in June; after August decreases (at a slower rate than it rose) until December.

New York.—Maximum.—July and August.
Minimum.—December, January, February, and March.
Death-rate begins to increase in April, two months earlier than in London.

Simple Cholera.

London.—Maximum.—July and August.
Minimum.—March and April.

Malignant Cholera.

London.—Maximum.—September.
Minimum.—April and May.
Mortality begins to rise in June, rises rapidly in July, maintains high and steady position in August, runs up to absolute maximum in September, and then rapidly falls.

Diphtheria.

London.—Maximum.—September to end of the year.
Minimum.—Middle of March to beginning of September.
Deaths remain above the average from September to the beginning of March.

New York.—Maximum.—December.
Minimum.—August.
Deaths above average from October to February; below it during the rest of the year.

Whooping-cough.

London.—Maximum.—February, March, and first half of April.
Minimum.—September and October.
Death-rate above average from middle of December to beginning of June.

New York.—Maximum.—Larger, September; smaller, February.
Minimum.—Larger, November; smaller, June.
The two maxima occur from August to September, and from February to April. The two minima are from October to January, and from May to July.

Influenza.

London.—Maximum.—November, December, and January.—March and April.
Minimum.—Other months of the year.
Owing to rarity of epidemics and the suddenness with which the disease appears and disappears, this cannot be accepted as the true curve of influenza.

Erysipelas.

London.—Maximum.—November.
Minimum.—Middle of June to middle of September.
Deaths from erysipelas are above the average from the middle of September to end of March; below for the rest of the year.

Puerperal Fever.

London.—Maximum.—November to March.
Minimum.—From middle of June to fourth week of September.
The curve of mortality tallies closely with that for erysipelas.

Hydrophobia.

London.—Maximum.—June, July, August, September, December; absolute, December.
Minimum.—February, March, April, May.
Calculation is based on fifty-six deaths in thirty years, twenty-three of which occurred in 1865–6–7.

Fevers in general.

London.—Maximum.—Beginning of September to end of January.
Minimum.—From April to August.
This curve has a well-marked character, though the departure from the average is never great.

PERIODS OF MORTALITY IN GENERAL DISEASES OF CONSTITUTIONAL TYPE, BOTH SEXES AND ALL AGES.

Rheumatism.

London.—Maximum.—End of November and beginning of December.
Minimum.—August and beginning of September.
The large November December maximum is prolonged, but in a diminished form, to the spring months.

Gout.

London.—Maximum.—Middle of March to end of April.
Minimum.—Beginning of June to end of year; absolute, September.
A large increase takes place in last week in year.
Another in middle of March ushering in annual maximum.

Cancer and Cancrum Oris.

London.—Maximum.—None.
Minimum.—None.

Scrofula.

London.—Maximum.—Larger, middle of April to first week of August; smaller, in October.
Minimum.—January, February, September, November, December.

Mesenteric Disease and Scrofula.

London.—Maximum.—Middle of July to middle of September.
Minimum.—End of December to beginning of February.
The mortality follows curve of temperature very closely.
New York.—Maximum.—July, August, and September.
Minimum.—December to early part of June; absolute, December and January.

Diabetes.

London.—Maximum.—None.
Minimum.—None.

Purpura and Scurvy.

London.—Maximum.—March to July.
Minimum.—December to beginning of January.

PERIODS OF MORTALITY OF LOCAL DISEASES IN BOTH SEXES AND ALL AGES.

Diseases of the Digestive System.

Thrush.

London.—Maximum.—Last week in July to third in August.

Minimum.—For the rest of the year; absolute in April and May.

The curve is identical in chief features with that of bowel complaints.

Cynanche—Quinsy; Tonsillitis.

London.—Maximum.—Middle of October to end of March; absolute, end of December and beginning of January.

Minimum.—August and beginning of October.

Maximum period is attended with a fall during February.

Gastritis.

London.—Maximum.—None.

Minimum.—None.

Enteritis.

London.—Maximum.—End of June to beginning of October; absolute, first week in August.

Minimum.—January, February, March, April, May, November, December.

Dysentery.

London.—Maximum.—June to November; absolute maximum, second week in September.

Minimum.—April and May.

From November to June death-rate under the average.

Intussusception.

London.—Maximum.—March, August, December, and first half of January.

Minimum.—September to November, and again in February.

Features very imperfectly marked.

Hernia.

London.—Maximum.—End of December, and beginning of January.

Minimum.—End of May and beginning of June.

Below average from May to middle of November.

Diseases of the Heart and Circulation.

Pericarditis.

London.—Maximum.—Middle of October to middle of May; absolute, November.

Minimum.—Middle of June to middle of September.

Curve resembles that for rheumatism.

Heart Disease Generally.

London.—Maximum.—November to March; absolute, December and January.

Minimum.—Middle of April to middle of November; absolute, middle of August to middle of September.

New York.—Maximum.—November to May, with fall in February; absolute, December and January.

Minimum.—Middle of June to middle of October.

Curves for London and New York correspond closely.

Respiratory Organs.

Croup.

London.—Maximum.—Middle of November to end of April; absolute, February and March.

Minimum.—Middle of May to end of September; absolute, middle of June to middle of August.

Absolute maximum is in early spring; absolute minimum in middle of summer.

New York.—Maximum.—From October to April; absolute, November and December.

Minimum.—May to September; absolute, July and August.

The curves for London and New York essentially agree.

Laryngitis.

London.—Maximum.—Beginning of December to end of May; absolute, last three weeks of March.

Minimum.—June to November; absolute, second week in September.

Sharp fall in January in maximum.

Bronchitis.

London.—Maximum.—November to March; absolute, second week in January.

Minimum.—April to October; absolute, August.

Above the average from November to April; below from May to October.

New York.—Maximum.—November to March; absolute, middle of March.
Minimum.—June to middle of November; absolute, first week in August.
The number of deaths from bronchitis in New York is only one-twentieth of the whole deaths, while in London it is one-eighth of the whole.

Asthma.

London.—Maximum.—From November to April; absolute, second we in January.
Minimum.—The beginning of May to end of October; absolute, August.

Pneumonia.

London.—Maximum.—November to April; absolute, December.
Minimum.—Beginning of May to end of October; absolute, August.
The curve generally same as for bronchitis, but absolute maximum earlier.

New York.—Maximum.—Beginning of November to middle of May; absolute maximum, March.
Minimum.—Middle of May to beginning of November; absolute, July and August.

Phthisis.

London.—Maximum.—January to middle of June, and middle of November to middle of December; absolute, middle of March.
Minimum.—Middle of July to middle of November; absolute, fourth week of September.
The deaths from this disease are nearly one-eighth of all the deaths that occur.

New York.—Maximum.—Middle of December to middle of May; absolute, March.
Minimum.—Middle of May to middle of December; absolute, June.
The deaths from this disease in New York are greater than in London, viz., one-seventh of the whole.

Pleurisy.

London.—Maximum.—Middle of November to second week of June; absolute, December and January.
Minimum.—Beginning of July to end of October; absolute, July and August.
The curve is subject to numerous fluctuations, and resembles curve for rheumatism and pericarditis rather than bronchitis, pneumonia, or asthma.

Lung Disease Generally.

London.—Maximum.—From beginning of November to end of May; absolute, December and January.

Minimum.—June to November; absolute, July and August.

This group includes all diseases of the lungs not already specified.

Diseases of the Nervous System.

Cephalitis.

London.—Maximum.—From beginning of February to end of July; absolute, beginning of April.

Minimum.—From beginning of September to January; absolute, September, October, and November.

Curve fluctuates considerably.

New York.—Maximum.—Beginning of February to end of August; absolute, July.

Minimum.—Beginning of September to beginning of February; absolute, November.

Hydrocephalus.

London.—Maximum.—From second week in February to beginning of August; absolute; March and April.

Minimum.—Second week in August to beginning of February; absolute, last week in October.

Mortality shows secondary increase in July as a constant feature.

New York.—Maximum.—January to beginning of August; absolute, April and July.

Minimum.—Second week in August to first in January; absolute, October, November.

Apoplexy.

London.—Maximum.—Middle of November to middle of April; absolute, December, January.

Minimum.—Middle of April to middle of November, with a rise in the last week in June; absolute, third week of July to beginning of September.

New York.—Maximum.—Beginning of December to end of May; absolute, March.

Minimum.—Beginning of June to end of November; absolute, July, August, September.

Paralysis.

London.—Maximum.—Middle of November to end of April; absolute, end of January.

Minimum.—Beginning of May to middle of November; absolute, third week in September.

Differs from apoplexy in having maximum fatality in midwinter.

Epilepsy.

London.—Maximum.—Last week of December to third week of April; absolute, third week of March to first week of April.

Minimum.—Middle of July to first week of September; absolute, last week in August.

Convulsions.

London.—Maximum.—December to end of April; absolute, February and March.

Minimum.—Beginning of May to middle of November, with a small secondary maximum in July; absolute minimum in September—October.

New York.—Maximum.—June, July, and August; absolute, July.

Minimum.—End of September to end of December; absolute, November, December.

Slight maximum in July in London is much exaggerated in New York curve.

Insanity.

London.—Maximum.—December, January, June, March, April; absolute, December and January.

Minimum.—Beginning of July to November; absolute, September, October.

The curve is very irregular.

All Nervous Diseases.

London.—Maximum.—Beginning of December to close of April; absolute, March, April.

Minimum.—Middle of May to close of November; absolute, September, October.

New York.—Maximum.—February to end of May slight, and close of June, July to middle of August; absolute, July.

Minimum.—Middle of August to middle of January; absolute, November.

Curve differs in New York from London owing to great maximum in July from sunstroke.

Brain Diseases.

London.—Maximum.—From beginning of December to end of April, with slight increase in July; absolute, March.

Minimum.—From end of July to end of November; absolute, September, October.

Curve almost identical with that for epilepsy. Includes all brain affections, except convulsions, epilepsy, paralysis, apoplexy, cephalitis, insanity.

Diseases of the Absorbent and Glandular System.

Hepatitis.

London.—Maximum.—Beginning of May to end of September; absolute, August.

Minimum.—October to end of April; absolute, December, January.

Jaundice.

London.—Maximum.—March slight, June with a fall in July, through July, August, September; absolute, August.

Minimum.—November to June, with slight rises above the average in February, March, April; absolute, December, January, February.

Curve much resembles that of Hepatitis.

Bright's Disease of Kidney.

London.—Maximum.—October to May; absolute, February, March, with a dip in December.

Minimum.—Middle of May to end of September; absolute, August, September.

Kidney Disease (General).

London.—Maximum.—End of November to end of April; absolute, December, January, and April.

Minimum.—Middle of May to September; absolute, June, August.

Diseases of the Membranous System.

Skin Disease.

London.—Maximum.—October to middle of January; absolute, November.

Minimum.—End of May to beginning of September; absolute, June.

This curve comprehends all skin diseases except phlegmon and ulcer.

Diseases from Natural Accidents.

Childbirth. (Mother.)

London.—Maximum.—Second week of October to end of March; absolute, December, January.

Minimum.—May, June, July, August; absolute, June to August.

Premature Birth.

London.—Maximum.—January, February, May, July, August, December.

Minimum.—During remaining months.

Curve shows little variation from the average through the year.

Privation.

London.—Maximum.—December to middle of April.

Minimum.—Middle of April to end of November.

Curve allied to that of disease of respiratory organs.

Want of Breast Milk.

London.—Maximum.—July, August, and September; absolute, July, August.

Minimum.—October to end of June; absolute, May.

This curve is allied to that from diseases of abdominal organs.

Alcoholic Diseases and Delirium Tremens.

London.—Maximum.—Beginning of May to end of September; absolute, July.

Minimum.—Beginning of October to beginning of May, with rise to the average in October, and slightly above the average in first week of new year; absolute, January, February, March, December.

The curve for delirium tremens stands alone, resembles no other curve, and is steady.

Suicide.

London.—Maximum.—Latter part of March to latter part of August; absolute, end of June.

Minimum.—End of August to March; absolute, beginning of February.

New York.—Maximum.—Beginning of April to end of September; absolute, May.

Minimum.—Beginning of October to beginning of April; absolute, February.

Both curves have the maximum period in spring and early summer.

From the details of important facts above recorded we gather information of the most useful and practical kind. There is probably nowhere in medical science such an epitome of disease as that recorded in Messrs. Buchan and Mitchell's papers. From the researches of these distinguished men we can indeed forecast, in these islands, the course of many diseases with a precision that may to a large degree be called exact.

CHAPTER V.

ATMOSPHERICAL, METEOROLOGICAL, AND CLIMATIC CAUSES CONSIDERED IN DETAIL.

From the array of facts which have passed under our observation we have been able to arrive at certain general conclusions, which are of extreme practical value. It will be instructive now to inquire whether the facts relating to disease can be accounted for as connected with particular atmospherical conditions. In other words, are the phenomena of disease dependent upon particular atmospherical variations, or upon particular combinations of them?

Atmospheric Temperature and Damp.

The influence of temperature on disease has ever been a fertile subject of observation by skilled inquirers. Dr. William Farr, however, was the first to treat upon it with precision, and to bring the effects of variation of temperature on life into what may be called a calculable form. In one of his early tables he described that after twenty years of age the danger of dying from a fall of temperature is doubled every nine years.

Thus, out of the same members living, if one die at thirty years, two will die at thirty-nine, four at forty-eight, eight at fifty-seven, sixteen at sixty-six, thirty-two at seventy-five, and sixty-four at eighty-four, from the same wave of cold.

The wave of cold cannot, however, of itself be taken as the cause of all that depends upon climatic influence, and Messrs. Buchan and Mitchell, recognizing this fact, have commented on temperature and moisture, together, in relation to disease. They divide the London year into six periods, each one of which has a climate peculiar to itself. The periods are as follow:

The *first* period, extending from the fourth week of October to the third week of December, is marked by *dampness* and *cold.*

The *second* period, extending from the fourth week of December to the third week of February, is marked by *cold.*

The *third* period, extending from the fourth week of February to the second week of April, is marked by *dryness* and *cold.*

The *fourth* period, extending from the third week of April to the fourth week of June, is marked by *dryness* and *warmth.*

The *fifth* period, extending from the close of June to the fourth week of August, is marked by *heat.*

The *sixth* period, extending from the first week of September to the third week of October, is marked by *dampness* and *warmth.*

During the *first of these periods*, marked by *dampness and cold*, seventeen diseases show a rapid increase of mortality, and twenty-five a mortality greatly above the average. Ten diseases, namely, measles, diphtheria, typhoid fever, childbed fever, rheumatism, pericarditis, aneurism, pneumonia, skin disease, and cyanosis, present an absolute maximum. Fourteen diseases, half of which are connected with the nervous system, show an increase of mortality. Twelve show a mortality considerably below the average, three of these being scrofula, cephalitis, and jaundice, and nine bowel complaints, or diseases connected with the nervous system.

In the *second period*, characterized by *cold*, six diseases begin to show an increased mortality, whooping-cough showing a rapid increase. Forty present a mortality considerably in excess. Seventeen, namely, small-pox, quinsy, typhus, delirium tremens, paralysis, insanity, convulsions, heart disease, bronchitis, pleurisy, asthma, other lung diseases, hernia, kidney disease, ulcer, childbirth, and old age, present the annual maximum. Seven diseases begin to decrease, five showing a rapid decrease. Twelve fall much below the average; five, namely, purpura and scurvy, delirium tremens, tabes mesenterica, hepatitis and suicide, reaching the minimum. Diseases of the respiratory organs show the greatest mortality during this period.

In the *third period*, characterized by *dryness* and *cold*, three diseases show an increase of mortality, and three of them a rapid increase. Thirty-four yield a mortality greatly in the excess. Fifteen, namely croup, whooping-cough, privation, dropsy, mortification, consumption, hydrocephalus, apoplexy, chorea, epilepsy,

convulsions, brain disease, laryngitis, Bright's disease, and teething, yielding a maximum. Twelve begin to decline; four present a rapid decline; eleven fall below the average, one of them, scarlet fever, declining to the annual minimum. Diseases connected with the nervous system show the highest death-rate in this period, and no complaint of which the nervous system is believed to be the seat has its minimum at this season.

In the *fourth period*, characterized by *dryness* and *warmth*, nine diseases begin to increase in their mortality; nine show a rapid increase. Fifteen rise above the average, nine of which, namely, ague, remittent fever, gout, purpura and scurvy, scrofula, cephalitis, intussusception, joint disease, and suicide, attain or retain their annual maximum. Nineteen begin to decline from the maximum; nine show a rapid decline. Eighteen are below the average, eleven of them, namely, diphtheria, typhoid, dysentery, diarrhœa, cholera, want of breast-milk, thrush, enteritis, ulcer, atrophy and debility, reaching their annual minimum. This is the healthiest of all the periods; the diseases of the respiratory and nervous systems rapidly diminish, and bowel complaints are at the lowest until just upon the close of the period.

In the *fifth period*, characterized by *heat*, four diseases begin to increase in their mortality, ten showing a rapid increase. Sixteen are above the average, diarrhœa, summer cholera, want of breast-milk, delirium tremens, thrush, tabes mesenterica, gastritis, enteritis, jaundice, and atrophy and debility, attaining their annual maximum. Ten diseases begin to decline, nine showing a rapid decline. Thirty-one are below the average, twenty of which, namely, croup, erysipelas, childbed fever, rheumatism, dropsy, mortification, apoplexy, epilepsy, pericarditis, heart disease, laryngitis, bronchitis, pleurisy, pneumonia, asthma, other lung disease, Bright's disease, kidney disease, skin disease, and cyanosis, attain or maintain their annual minimum. The marked diseases of this period are bowel complaints. Delirium tremens has also its maximum in this period.

In the *sixth period*, characterized by *dampness* and *warmth*, twenty-one diseases begin to increase in their mortality, nine showing a rapid increase. Nine run above the average, three of these, namely, scarlet fever, dysentery, and cholera, attaining or maintaining their annual maximum. Six begin to decline from the maximum; seven show a rapid decline. Twenty-seven are

greatly under the average, fifteen of these, namely, small-pox, quinsy, whooping-cough, typhus, remittent fever, gout, consumption, hydrocephalus, paralysis, insanity, convulsions, brain disease, hernia, teething, and old age, attaining or remaining at their annual minimum. Scarlet fever is the only disease which reaches its maximum death-rate during this period, viz., in October. The period altogether is very healthy.

A further analysis of these researches indicates that heat and not cold is the great destroyer of the infant life of London, while cold and not heat is the great destroyer of the aged.

We find an explanation of the effects of cold by estimating the force of vitality at different ages. We may assume that the body reaches its maximum of development at the age of thirty. At this period, if it be quite healthy, it generates by its own chemical processes so much force as shall enable it, within given bounds, to work its own machinery, to call forth at will a limited measure of extra force, and to supply a fluctuating loss that may be conveyed from it by contact with the surrounding air, and by other substances that it may touch, and that are colder than itself. The body yields, therefore, applied force, reserved force, and waste force; and these, under ordinary circumstances, are sufficient to maintain the perfect organism in effective life. So much active force gives the body the power to perform so much labor; so much reserved force supplies it with the power to perform a measure of extra labor to meet emergencies; so much waste force enables it to resist the external vicissitudes without trenching on the supply which is ever wanted to keep the heart pulsating, the chest heaving, the glands secreting, the digestive apparatus digesting, and the brain receiving or thinking.

Let this distribution of force be disturbed, and straightway the life-power is reduced. If we use the active force too long, we become exhausted, and call upon the reserve; and if we still continue the process we fail at last, unless sleep forces itself upon us, and brings, with the rest it insures, renewal of power. If we are robbed of the waste force quicker than we can supply it again, exhaustion is produced; insufficient nervous control over the vascular canals succeeds, and therewith that congestive condition of the lungs and other vascular organs, under which death is so easy when exhaustion is severe.

That the exhaustion should be more rapid in the man who

has reached his prime is but natural. In his past he has been a growing, developing body, and in the course of development he has used up an excess of force commensurate with the demands of his growth. When he stops in development, and stands on a fair level with the external forces opposed to him, then his own force, for a short time balanced, soon becomes second in command. He feels cold more tenderly; if his rest be broken, his demand for artificial heat is urgent; if he lose or miss food, he fails rapidly; and, returning to our facts on the influence of external temperature on mortality, these many sources of failure are the reasons why a fall in the thermometer sweeps away our population so decisively according to its age.

The influence of temperature is very decisive in regard to certain acute diseases. Thus, as Boudin shows, yellow fever demands a temperature of 68° Fahr. in order that it should take the epidemic form; while epidemic plague ceases in Egypt when the temperature approaches 82° Fahr. Phthisis pulmonalis, so fatal in Great Britain, diminishes as the climate becomes warmer, as in the West Indies, Ceylon, and Mauritius. It also diminishes as the climate becomes colder, as in Canada and Nova Scotia.

Atmospheric Pressure.

The effects on health of changes of weather preceding rain have long been known, and since the discovery of the atmospheric pressure, and of the instrument called the barometer, with which that pressure is measured, the idea that there is a close connection between a fall of the barometer and certain painful affections, like neuralgiac and rheumatic pains, has become general. In our day this subject has been remarkably illustrated, on one side of it, by the observations which have been scientifically made on the effects of pressure upon men who are obliged to work in compressed air, and who suffer from the affection described at p. 392–4 as *caisson*, or *coffer-dam* disease. The subject has also been studied on the other side by observations on the effects of reduced pressure upon persons who are ascending mountains, or upon those who are rising, in a balloon, into a higher and rarefied atmosphere.

The influence of atmospheric pressure, which I have briefly described in the pages above referred to, is variable according to

the susceptibilities of the persons who are subjected to it. In fact, there is nothing which shows more conspicuously the difference of human susceptibilities to external influences than the pressure of air. Dr. Andrew Smith, in his record of the phenomena he noticed in the *caisson* of the East River Bridge at New York, found that a large proportion of the men bore the excessive pressure,—reaching at last to thirty-six additional pounds to the square inch,—without the slightest ill effect; whilst in others some severe symptoms resulted from a very short exposure to slight pressure. In one instance a student of engineering, after a brief stay under an additional pressure not exceeding fifteen pounds, was seized on coming into the air under ordinary pressure, with temporary paralysis. The difference, Dr. Smith thinks, lies in the difference of efficiency of the vaso-motor system, or perhaps in the structure of the blood-vessels themselves, so that in one case the vessels resume at once their natural condition when the pressure is removed, while in the other case the abnormal distribution of the blood persists in certain parts of the vascular surface. "Whatever," he argues, "the predisposing condition may be in this latter class of cases, we have only to assume its existence in an exaggerated degree to bring the subject within the range of ordinary barometrical changes. If one man can bear a change of ninety inches, and come out of it to the ordinary pressure without feeling it, while another is paralyzed by a change from thirty inches of pressure to the ordinary, it is not incredible that a third may have aching limbs as a result of being subjected to a fall of two inches of pressure."

This is the reasoning suggested by Dr. Smith, and from these inferences, as well as from many others which he has drawn from his unrivalled field of research, he explains why some cicatrices, —scars,—such as those following gunshot wounds, are specially prone to be subjected to neuralgiac pains during change of weather. He also explains why, on bright days, when the air is light, and the barometer is high,—when, that is to say, the greater atmospheric pressure on the surface of the body drives the blood into the interior of the body, and especially into the organs in closed cavities, such as the brain,—the mind is active, and the muscles vigorous; while on damp, foggy days, mental effort is irksome, the limbs drag, the appetite is small, and the whole tone of the system lowered.

The changes are more distinctive still in those who are prone to disease, and in whom the vessels are already enfeebled or changed in structure. There can be no doubt that the effects of reduced pressure tell with intense force on large populations who are already enfeebled.

I have dwelt on variation of the atmospheric pressure as a cause of disease, on account of its great practical meaning. It embraces so much. Whether the variation from high to low pressure ever acts as a primary cause of disease it is impossible to define, but that it acts as an exciting cause, of the most serious character, on persons predisposed to disease there can be no doubt whatever. A sudden reduction of the atmospheric pressure, which means a fall in the barometer, is attended with risk of pressure of blood, leading to pressure on nervous fibre and production of pain; to internal congestion; to fever; to apoplexy: while an increased pressure, which means a rise in the barometer, is attended with greater risk of injury from physical or mental shock.

The effect of the variation extends in yet another direction. I have pointed out in an essay on "Meteorology in Relation to Surgical Practice," that the atmospherical pressure plays an important part in the results of surgical procedures, and that with a falling barometer the chances of success are reduced.

Thus the time is *favorable* for operation,—

(*a*) When the barometer is steadily rising.

(*b*) When the barometer is steadily high.

(*c*) When the wet-bulb thermometer shows a reading of five degrees lower than the dry-bulb.

(*d*) When, with a high barometer and a difference of five degrees in the two thermometers, there is a mean temperature at or above 55° Fahr.

The time is *unfavorable* for operation,—

(*a*) When the barometer is steadily falling.

(*b*) When the barometer is steadily low.

(*c*) When the wet-bulb thermometer approaches the dry-bulb within two or three degrees.

(*d*) When, with a low barometrical pressure and approach to unity of reading of the two thermometers, there is a mean temperature above 45° and under 55° Fahr.

On the same point Dr. Addenill Hewson has published in the Pennsylvanian Hospital reports a register of 259 operations with

the accompanying meteorological conditions, and the results connected with the operations. These results, as stated by Dr. Hewson, stand as follows :—

"On the occasion of the 259 operations, the barometer was ascending in 102, descending in 123, and stationary in 34.

Fifty-four of the whole number were fatal ; 11 of them were operated on when the barometer was ascending, 35 when it was descending, and 8 when it was stationary.

Of the successful cases, 91 were operated on with an ascending barometer, 88 with it descending, and 26 with it stationary.

"From which it would seem," says Dr. Hewson, "that we got a mortality, when the operation was performed with the barometer ascending, of not quite 11 (10.7) per cent. ; of over 20 (20.6) per cent. with it stationary ; and over 28 (28.4) per cent. with it descending. Of the fatal cases, the average length of time which the patient survived the operation was only seven days when the barometer was ascending, and thirteen when it was descending ; and of the cases which died within three days over 75 per cent. were when the barometer was ascending."

Electrical Conditions of the Air.

From the experimental data recorded in the last chapter but one, it may readily be inferred that varying electrical conditions of the atmosphere lead to important states of body and to disease. The common experience tells us that many persons of an impressionable nature are painfully affected by electrical storms, and are indeed able to predict such storms. The subject invites a long essay, but it also calls for more research than has yet been made in regard to it.

One of the best series of observations I have ever read was sent to me by my friend Mr. Hingeston of Brighton. "If watched attentively, the clouds," says my friend, "will be seen to approach and recede from each other in a manner similar to bodies charged with positive and negative electricity. They may be observed also to rotate on an axis of their own, this rotation being from left to right. When these clouds are seen the wind is as a rule from the west. The mortality is low, but illness of a curable and transient nature is frequent. Virulent epidemics do not prevail. The influenza A.D. 1729 passed over Europe from

S.E. to N.W. with a moist, cloudy, foggy season; and the spotted fever of A.D. 1847 passed from E. to W. over the north of Europe, across Great Britain and Ireland, till it finally reached America."

During the passage of white-headed cumuli the electrometer is very active; in mists the electricity is negative, feeble, or nil. During "thundery weather," as it is called, head affections and bowel complaints are noticed. There is a peculiar symptom, analogous to that which arises in cases of injury to the spine, viz., the colon being greatly surcharged with wind: it is an evidence of direct exhaustion of the nervous centres.

The large white-headed cumuli that collect in clear bright days are rotary storms of hail, rain, or thunder, gyrating from left to right. Several of these gyratory storms keep marching onward in alternate spaces, marshalled in a vast circular array, and rolling round a circumference of bright translucent calm.

On the approach of one of these masses of vapor, the mercury of the barometer and thermometer first falls, and then rises with great rapidity. The accompanying and residual state of the atmosphere is congenial to health. Cases of debility experience a favorable reaction, the air we breathe at these moments being antagonistic of disease.

With the breaking up and dissolving of these large cumuli there is electric action, and most likely explosion, just as the vapor is being condensed into water.

The entire atmosphere changes. Everything is dull and gray. In the damp weather dyspepsia chiefly prevails—the acid indigestion of gouty habits, the scrofulous, indolent, and pitiable host of "never-wells."

Rheumatism, which some have supposed to arise from a sudden loss of electricity, occurs in damp weather, when the amount of animal electricity is the smallest, and the most readily parted with.

During the prevalence of cholera the cirrus cloud is rare; but the cirro-strati, which occupy a lower stratum of the atmosphere, are frequent at noon, and accompany the sun for three or four hours in his meridian height. A calm prevails. Indolent cirro-cumuli lodge over the hills. The distance is dim, and a sticky vapor, charged with small black flies, pervades everything. The barometer stands obstinately at 30, and the wind is from the N.W.

or S.E. During the cholera of 1854 the wind was from the S.E. to N.W., and so it was in 1832 and 1849.

Some observers have remarked that the declination of the needle is very great during the prevalence of the Asiatic cholera, and that it also corresponds with certain changes in the vegetable kingdom, as, for instance, the potato rot.

We have some facts to show cause why we should connect disease with the greater or less amount of electricity, signified by the electrometer. It would seem that, in the non-electric states of the air, diseases of a low type prevail. Thus, in the Registrar-General's return for the week ending 14th July, 1855, we find it stated, "weak positive electricity throughout the week," and the mortality return of the same date shows that the chief deaths were from small-pox, whooping-cough, scarlatina, diarrhœa, and typhus. On the contrary, in the week ending 8th September, electricity is "positive," and mortality "not high for the season."

On the 13th and 14th September, 1854, when cholera was at its maximum, it is reported of electricity, "none was shown."

Again, for week ending 22d September, 1855, mortality "shows a decrease of about one hundred in each of the three previous weeks, and indicates a satisfactory state of the public health;" while the electricity was "positive," strongly positive, "and active throughout the day."

If we consider that every living creature is as much an electrical machine as each cloud; that the earth itself is the largest and most powerful electrical machine of all; that all things are always exchanging their electricities with each other; and that lightning destroys myriads of insects, as well as some animals and human beings, at a single flash, it is past contradiction that electricity must be a grand actor in every form of life, whether of health or disease.

The violence of the winds, if not their directions, seem to be electro-magnetic. And the partial rarefaction of the air by heat, and its condensation by cold, hitherto employed for explaining the force and current of the winds, are, most likely, only striking parts of terrestrial electro-magnetism. Moreover, the sensorial effects of the electric fluid are proof paramount of its pathological energy. We have, therefore, every possible reason for regarding the kind of clouds as indications of the kind of atmosphere in relation to disease; and the various forms assumed by the vapors

condensing or dissolving in the air may be considered, not only as picturesque beauties in the landscape, but also as criteria for judging of some of the most potent effects resulting from the operation of an experiment, silently and delicately performed, upon the functions and sensations of animated beings. These signs only require reducing to some familiar characters, in order to render them practically serviceable; and then, when once recognized, they might be read off at a glance, and brought into daily use as easily as the dial-plate of the electric wire, or the minute-hand of our watch, in counting the pulse at a patient's wrist.

In 1854 the late Dr. Moffat joined me in contributing an essay on meteorological changes and disease, in which he formed the hypothesis that there were certain periods during which ozone was present in the air, and that during such periods, called by my colleague, ozone periods, diseases affecting the respiratory organs were peculiarly prevalent. Dr. Moffat continued his observations until the close of his useful life, and was led to trace a connection between periods of phosphorescence and the acute forms of disease. A review of his laborious work leads me to the conclusion that it remains incomplete.

On the Influence of Particular Winds and on General Climatic Differences.

That certain winds are provocative of certain symptoms of disease, and that they intensify certain symptoms in those who are suffering from disease, is a part of universal, as well as of medical, knowledge. Thus the southwest wind is known to be unfavorable to acute inflammatory conditions; the north and northeast winds to neuralgic and rheumatic conditions; while the drying, cutting, depressing east wind is fatal to those in whom the store of vital energy is very low. But here we are wanting in sound method for determining the precise part played by the winds as causes of disease. It is not obvious that the winds determine the origin of any disease; and whether they intensify any by a special action of their own, independently of heat, cold, moisture, electrical tension, and other such active influences, remains to be discovered.

It has been surmised that during some great perturbations of nature, changes may take place in the chemical constitution of the

atmosphere, and that these changes may account for phenomena of disease. The passage of air over certain soils has been considered sufficient to disturb its natural chemical state, and to render it directly noxious to human life. In the Grotto del Cane, and in some other rare positions, the air is sufficiently admixed with a poisonous gas (carbonic anhydride) to render it dangerous to breathe; but beyond these exceptional and well-known instances, we have no proof whatever of any such modification of the chemical constitution of the atmosphere as would provoke a special disorder, although we have seen that the oxygen of the atmospheric sea may be changed in physical quality, with injurious effect on life.

To all our present experience the combination, or more correctly, the mechanical admixture of the gases that make up the atmosphere,—the oxygen and nitrogen,—remain always steadily balanced and fitted to support the vital processes. The dangers which spring from vitiation of atmospheric air, from undue removal of oxygen, from introduction of carbonic acid or other poisonous gas or vapor, are, therefore, artificial dangers, invented and promoted by our own hands, and due, consequently, to the controllable errors of social life.

On the general subject of winds and geographical distribution of disease we are much indebted to the researches of Mr. Alfred Haviland, who has devoted many years of splendid labor to this investigation. His inquiries extend particularly to four classes of disease; namely, rheumatism; its concomitants, heart disease and dropsy; cancer in females; and, pulmonary phthisis.

Respecting heart disease and dropsy, which Mr. Haviland considers are almost entirely dependent on rheumatism, he infers, —That wherever the sea air has uninterrupted access, as over a flat country, up broad vales or valleys, and elevated country, we find a low mortality from heart disease and dropsy. And that, on the contrary, in places where the tidal wave has no access, where the rivers run at right angles to its course, or to that of the prevailing winds, there is the highest mortality from the same causes of death.

Respecting cancer, Mr. Haviland infers,—1. That the hardest and most elevated rocks, or the most absorbent, like the oolite and chalk, are the sites where the least mortality from cancer is found.

2. That along the river-courses which flood their banks, seasonally, are to be found the districts in which the highest mortality from cancer takes place.

3. That wherever, from the nature of the rocks forming the watershed, the floods are much discolored by alluvium, and where, from the flatness of the country, the floods are retained and not easily drained off, there we find the greatest mortality from cancer among females.

Respecting pulmonary phthisis or consumption Mr. Haviland infers, that districts with sheltered positions yield a low rate of mortality from the disease. That districts with a general aspect favorable to the malign influence of the east wind yield a high death-rate. That damp clay soil is coincident with a high mortality; and, that elevated ridges of non-ferruginous and infertile carboniferous limestone and coal formation, and elevated, hard, unfertile, and non-ferruginous Silurian formations, form districts of extensive high mortality from the disease. That elevated parts exposed to westerly, north-westerly, easterly, and south-easterly winds are characterized by high mortality. That a sheltered position, a warm, fertile, well-drained, ferruginous soil are coincident, as a rule, throughout England and Wales, with low mortality from phthisis.

Touching this last question I may add that the influence of a seafaring life as a preventative of phthisis has been matter of important observation. In 1856 Boudin showed that while the deaths from consumption in the British army were, in the Line, 8.9 in 1,000 men, and in the Guards, 12.5 in 1,000 men, in the British navy from 1830 to 1856 inclusive, the deaths from phthisis were 1.76 in 1,000 men.

CHAPTER VI.

On Parasites in Connection with Disease.

A certain number of diseases have for their cause the introduction into the body of what are called parasites.

These parasitic forms of life are of two or, as some would opine, of three kinds. Certain of them are of distinct animal character; others are as distinctly of vegetable character; others, it is assumed, lie between the animal and vegetable kingdoms.

Of late years the subject of the origin of disease from parasitic forms of life, taken into the body by means of food or air, or received upon the outer surface of the body, has attracted an unusual degree of attention, an attention, indeed, which has led to neglect of other branches of learning relating to the study of causes of disease in their entirety, and thereby to retrogression of knowledge.

The real knowledge which has been acquired in respect to the action of parasitic forms of life in producing disease is very clearly of three distinct values. Some part of it is quite certain, and is of the greatest value. Another part of it is theoretical, and is waiting for more proof in order to become valuable. Another part is entirely hypothetical, and is in various ways so exaggerated and childish as to be valueless, if not mischievous.

The Royal College of Physicians, to which I have so often referred as my authority for classification of disease, places the "Human Parasites" in three subdivisions under the following names:

I. Entozoa. Of which there are three classes:

A. Cœlelmintha. *English synonym*, Hollow worms. *Definition:* Worms with an abdominal cavity.

B. Sterelmintha. *English synonym*, Solid worms.

C. Accidental Parasites. *Definition:* Internal parasites, having the habits, but not referable to the class, of entozoa.

II. Ectozoa. In which are included the various acari, or lice, which infest the outer surface of the body.

III. Entophyta and Epiphyta. In which are included the algæ, fungi, and mycroderms, that have been found on the surfaces or in the cavities of the body.

Studied in relation to diseases of the different systems of the body in the manner followed out in this volume, Parasites may be classified as follows:—

PARASITES AFFECTING THE DIGESTIVE SYSTEM AND INTESTINAL CANAL.

Entozoa.

Class A. Cœlelmintha.

Ascaris lumbricoides. (Linnæus.) *Habitat:* Intestines.
Ascaris mystax. (Rudolphi.) *Habitat:* Intestines.
Trichocephalus dispar. (Rudolphi.) *Habitat:* Intestines.
Sclerostoma duodenale. (Cobbold.) *Syn.* Anchylostomum duodenale. *Habitat:* Duodenum.
Oxyuris vermicularis. (Bremser.) *English synonym,* Thread-worm. *Habitat:* Rectum.

Class B. Sterelmintha.

Bothriocephalus latus. (Bremser.) *Habitat:* Intestines.
Bothriocephalus cordatus. (Leuckart.) *Habitat:* Intestines.
Tænia solium. (Linnæus.) *Habitat:* Intestines.
Tænia mediocanellata. (Küchenmeister.) *Habitat:* Intestines.
Tænia acanthotrias. (Weinland.) *Habitat:* Intestines.
Tænia flavopuncta. (Weinland.) *Habitat:* Intestines.
Tænia nana. (Siebold.) *Habitat:* Intestines.
Tænia lophosoma. (Cobbold.) *Habitat:* Intestines.
Tænia elliptica. (Batsch.) *Habitat:* Intestines.
Cysticercus of the Tænia marginata. *Synonym,* Cysticercus tenuicollis.
Distoma crassum. (Busk.) *Habitat:* Duodenum.
Distoma lanceolatum. (Mehlis.) *Habitat:* Hepatic duct; intestines.

Class C. Accidental.

Œstrus hominis. (Say.) *English synonym,* Larva of the gad-fly. *Habitat:* Intestines.
Anthomyia canicularis. (A. Farre.) *Habitat:* Intestines.

Entophyta and Epiphyta.

Leptothrix buccalis. (Wedl. Robin.) *English synonym,* Alga of the mouth.

Oidium albicans. (Link.) *English synonym,* Thrush fungus. *Habitat:* Mouth in cases of thrush, and certain mucous and cutaneous surfaces.

Sarcina ventriculi. (Goodsir.) *Habitat:* Stomach.

Torula cerevisiæ. (Turpin.) *Synonym,* Cryptococcus cerevisiæ. (Kützing.) *English synonym,* Yeast-plant. *Habitat:* Stomach; bladder.

PARASITES AFFECTING THE BLOOD.

Entozoa.

Class B. Sterelmintha.

Hexathyridium venarum. (Treutler.) *Habitat:* Venous blood.

Filaria sanguinis hominis. (Manson.) *Habitat:* Venous blood.

Distoma Hæmatobia. (Bilharz.) *Habitat:* Venous blood.

PARASITES AFFECTING THE LUNGS.

Entozoa.

Class A. Cœlelmintha.

Strongylus bronchialis. (Cobbold.) *Habitat:* Bronchial tubes.

PARASITES AFFECTING THE ORGANS OF SENSE.

Entozoa.

Class A. Cœlelmintha.

Filari oculi. (Nordmann.) *Synonym,* Filaria lentis. (Diesing.) *Habitat:* Eye.

Class B. Sterelmintha.

Distoma ophthalmobium. (Diesing.) *Habitat:* Eye.

PARASITES AFFECTING GLANDS.

Entozoa.

Class A. Cœlelmintha.

Eustrongylus gigas. (Diesing.) *Habitat:* Kidney; intestines.

Class B. Sterelmintha.

Tetrastoma renale. (Della Chiaje.) *Habitat:* Tubes of the kidney.

Fasciola hepatica. (Linnæus.) *Habitat:* Liver.

Hexathyridium pinguicola. (Treutler.) *Habitat:* Ovary.

Class C. Accidental Parasites.

Pentastoma denticulatum. (Siebold.) *Habitat:* Liver; small intestines.

Pentastoma constrictum. *Habitat:* Liver.

PARASITES AFFECTING THE MUSCULAR SYSTEM.

ENTOZOA.

Class A. Cœlelmintha.

Trichina spiralis. (Owen.) *Habitat:* Muscles.

PARASITES AFFECTING THE SKIN AND CELLULAR MEMBRANE.

ENTOZOA.

Class A. Cœlelmintha.

Filaria Medinensis. (Gmelin.) *Synonym,* Dracunculus Medinensis. *English synonym,* Guinea-worm. *Habitat:* Skin and subcutaneous tissues.

Class B. Sterelmintha.

Cysticercus of the Tænia solium. *Synonym,* Cysticercus telæ cellulosæ.

Echinococcus hominis, *or* Hydatid of the Tænia echinococcus. (Siebold.)

ECTOZOA.

Phthirius inguinalis. (Leach.) *English synonym,* Crab-louse.

Pediculus capitis. (Nitzsch.) *English synonym,* Head-louse.

Pediculus palpebrarum. (Le Jeune in Guillemeau.) Eyebrow-louse.

Pediculus vestimenti. (Nitzsch.) *English synonym,* Body-louse.

Pediculis tabescentium. (Burmeister.)

Sarcoptes scabiei. (Latreille.) *Synonym,* Acarus. *English synonym,* Itch-insect.

Demodex folliculorem. (Owen.)

Pulex penetrans. (Gmelin.) *English synonym,* Chigoe. *Habitat:* skin and cellular tissue.

Chionyphe Carteri. *Definition:* A cotton fungus occurring in the disease called Mycetoma. *Habitat:* Deep tissues, and bones of the hands and feet.

Achorion Schönleinii. (Remak.) *Habitat:* Tinea favosa.

Puccinia favi. (Ardsten.) *Habitat:* Tinea favosa.

Achorion Lebertii. (Robin.) *Synonym,* Trichophyton tonsurans. (Malmsten.) *Habitat:* Tinea tonsurans.

Microsporon Audouini. (Gruby.) *Habitat:* Tinea decalvans.

Trichophyton sporuloides. (Von Walther.) *Habitat:* Tinea Polonica.

Microsporon furfur. (Eichstädt.) *Habitat:* Tinea versicolor.

Microsporon mentagrophytes. (Gruby.) *Habitat:* Follicles of hair in Sycosis or Mentagra.

ENTOPHYTA AND EPIPHYTA.

In addition to the parasites classified in the official nosology under this division as algæ, there must now be named some which,

since the nosology was published, have received great attention from scientific observers.

Algæ. Bacteriaceæ.

A family of the order Schizomycetes, the individuals of which consist of spherical, oblong, or cylindrical cells, sometimes twisted, and which increase by transverse division, and live separately or in cell groups. Drs. Power and Sedgwick in their admirable "Medical Lexicon" divide them, after Cohn, into four tribes.

"*Sphærobacteria*, in which the cells are spherical.

"*Microbacteria*, in which the cells are short and cylindrical.

"*Desmobacteria*, in which the cells are filamentous.

"*Spirobacteria*, in which the cells are tortuous or screw-shaped."

Bacteridium.

"A genus of the family Vibriones, according to Devaine, filiform, straight or bent, more or less distinctly articulated, in consequence of an imperfect spontaneous division, and always motionless. Other members of the Bacteridia have been included as globular. The filiform are described by Cohn as *Bacillus*, the globular as *Micrococcus*." The Bacteridia which are most important to name here are,—

Bacteridium anthracis or *Bacillus anthracis.* The bacillus found in malignant pustule.

Bacteridium fermenti. The bacillus described as occurring in the leaven of wheat or barley.

Bacterium.

According to Cohn, Bacterium is the single genus of the tribe Microbacteria of the family Bacteriaceæ. The term most frequently applied to members of this family is "*Bacteria*."

Bacteria are described by Power and Sedgwick as short, cylindrical, or elliptical cells, hanging in pairs whilst undergoing transverse division. Under favorable nutrient conditions, and with good supply of oxygen, they move, freely, at times. They form no chains or threads, but they propagate in a connecting gelatinous mass, *zooglœa*, in regard to which they are distinguished from the sphærobacteria by the firmness of the intermediate substance,

and by the absence of any finely granulated appearance. Those most important to name in this place are,—

Bacterium carbunculare, said to be found in the blood of men and animals who have died with carbuncle. Defined as "motionless, flat, straight, highly refractile, without inflexion when short, and with one or two inflexions when long."

"*Bacterium catenula* (chain-like), a doubtful species, supposed to have been found in typhoid fever.

"*Bacterium cuneatum* (wedge-shaped), said to exist in putrefying blood, and in the intestines of horses and dogs dying of putrefactive diseases.

"*Bacterium termo*, described as two to five times as long as broad, about .0015 mm. in length; often two-jointed, with a vacillating movement, produced by a terminal flagellum. Found wherever putrefaction of either animal or vegetable matter is going on, and believed, by many, to be the active agent in that process. When putrefaction ceases they cease to be found."

Bacillus.

Meaning a little stick. (Power and Sedgwick.) "A genus of the tribe Desmobacteria of the family Bacteriaceæ. Distinguished from the other genus of the same tribe, Vibrio, by the straightness of the rods.

"*Bacillus anthracis.* Homogeneous and unjointed when fresh, and developing spores. It is found in the blood and diseased structures in the splenic fever of animals, and in malignant pustule.

"*Bacillus lepra.* A form of uncertain existence, supposed to be the cause of leprosy.

"*Bacillus malaria.* A form discovered by Krebs and Tommasi-Crudeli in the air and soil of malarious districts, especially in the Pontine Marshes, and believed by them to be the cause of intermittents. It consists of small, narrow, longish cylindrical spores, about half a micro-millimetre long, and rods of about the same breadth, and seven micro-millimetres in length. In the body of animals the spores develop into long filaments, which subsequently undergo transverse segmentation, so as to form a chain, in the segments of which new spores grow. They develop most freely in the spleen and the medulla of the bones."

Spirillum.

In addition to the divisions named above must be added the Spirillum, a parasite of the class algæ, and coming also under the head Bacteria. Spirillum is ranged by Dr. Vandyke Carter amongst "Bacteria (Schizophytæ), forming (like Bacillus) a member of the Nematogenous subsection, in which the component cells are arranged in rows, and come into a small group characterized by colorless, screw-shaped threads embracing three genera:—*Vibrio*, in which the filaments are short and slightly undulating; *Spirillum*, in which they are short, spiral, and stiff; and *Spirochæte*, in which they are long, spiral, and flexible."

Bacillus Tuberculosis.

A Bacillus supposed to be found in the sputa or expectoration of persons suffering from some forms of consumption, and in the walls and contents of tubercular cavities. The parasites, rendered visible by a process of double coloration, and usually demonstrated colored with methyline blue, are seen as minute rods about the third of a diameter of a blood corpuscle in length, and about one-sixth of their own length in breadth. In some of them spores are said to be evidenced, but in the specimens I have seen none were manifest.

CHAPTER VII.

On Parasites as Causes of Disease.

The reader who has studied carefully the history of disease in the part of this work devoted to the description of local diseases of natural origin, will easily have connected many of the parasites described in the last chapter with the diseases in which they have been found, and will to a considerable extent have learned the part they play as factors of disease.

It will, however, be advisable to consider this subject a little further on, in order to understand how far the presence of a parasite growth may be taken as a first or second cause of the phenomena of disease in the cases of disease in which the growth is discovered.

In this review it will, I think, be most convenient to follow out the exposition by a reference to the parasites under the three great divisions in which they are described at the opening of the last chapter, namely, as:

Entozoa, or Worms.

Ectozoa, or Acari.

Entophyta and *Epiphyta*, or Algæ, or Fungi.

Diseases from the Entozoa.

There are three kinds of the Entozoa, or worms, which affect the body as parasites.

1. The Nematode, or round worms.
2. The Cestode, or tape worms.
3. The Trematode, or fluke worms.

Nematode Disease.

The Nematode or round worms include the Trichina spiralis; the Ascaris lumbricoides or common round intestinal worm; the

Oxyuris vermicularis or thread worm ; the Dracunculus medinensis or Guinea worm ; and the Filaria sanguinus hominis.

Trichiniasis.

The trichinous flesh-worm disease,—Trichiniasis,—has assumed in some countries the character of an epidemic, but in England we have learned its history, chiefly, from isolated examples of it. In order that the disease may be induced the trichinous parasite must enter the body by the alimentary canal. The human subject derives the larval trichinæ from the muscular flesh of some animal on which he has fed. The parasite as it exists in this flesh is in the larval state,—the state intermediate between the eggs and the perfectly developed growth,—and in this condition it remains so long as it is embedded in the flesh. Received into the stomach of a man, or of any other animal, it develops into maturity in a few day. The female trichinæ give forth their embryos in abundance, and the embryos at once make their migrations through the cellular connecting network which holds all the active and muscular organs of the body in close connection.

In this country, disease from the presence of trichinæ in the tissues is very rare, and few English physicians have had opportunities of studying it. I have seen one portion only of a trichinous muscle derived from man, and in that case the existence of the parasite was not detected prior to death. On the continent there have been epidemics of Trichiniasis, attended, in extreme instances, with intense symptoms.

When the trichinous disease occurs it is marked in its most developed form by three stages. (*a*) A stage of intestinal irritation, gastro-enteric,—corresponding with the period of full development of the trichinæ, and the evolution of embryos within the canal. (*b*) A stage of moderate fever, attended with pains in the muscles like those of rheumatism, and accompanied, in some few examples, with a red rash, and boils,—corresponding with the time when the embryos find their entrance into the muscles and are becoming encysted there. (*c*) A prolonged or chronic stage of impaired muscular movement with emaciation,—corresponding with the after-period when the larvæ are entirely encysted in the muscle and are fixed in position. This last stage is not always well marked.

When the first or acute affection is over, and the parasite is duly lodged in its home, it happens, usually, that the evidence of the disease gradually ceases, and that the presence of the foreign intruder is not, actually, discovered until after the death of the person into whose organism it has intruded. Such was the state of the body which presented the one single instance I have known of trichinous affection.

The trichinous parasite in its larval condition enters the body, as we have seen, with infested animal food. There is no satisfactory evidence, however, that it ever becomes active when it enters after the food it infests has been subjected to perfect cooking and to the temperature of boiling water. This degree of heat, 212° Fahr., destroys quickly and completely the life of the embryo. The worst cases of disease have been those in which the sufferers have swallowed raw or imperfectly cooked infested flesh. Nevertheless, the larvæ enjoy a tenacious life ; they exist ready for development into the mature state even when the flesh in which they are encysted has passed into decomposition. The flesh of the pig is the most frequent carrier of the trichinous larvæ.

Lumbricoid Disease.

Other nematode worms, two of which are well known, produce symptoms of disease in the human subject. The large round worm, the Ascaris lumbricoides, is one of these common parasites. It attains often a considerable size, resembling in its appearance the ordinary earthworm. It is developed and retained in the intestinal canal, and creates, frequently, extreme irritation, leading to convulsions and comatose sleep in children, and to that emaciation which almost invariably occurs when a body foreign to the alimentary surfaces is long in contact with them.

Thread-worm Disease.

The small round worm, known as the thread or wire worm, Oxyuris vermicularis, is another parasite which infests the lower part of the alimentary canal, and in children is a frequent source of extreme irritation. As a rule it infests children only, but the rule is not without its exceptions. For a long time I had under observation a middle-aged man who, throughout his life, has recurrently been tormented by this parasite. The symptoms it

induces do not usually pass beyond those of local irritation, but occasionally there is extension of irritation, with phenomena of reflex muscular spasm.

The history of the migration of the Ascaris lumbricoides and Ascaris vermicularis, is not so clearly defined as we could wish; but it is certain that by some article of food or drink the larvæ of these parasites enter the alimentary canal, after which entrance they develop there. It has been assumed that the introduction is through impure water, or by vegetable substances and fruits which carry water containing the larvæ.

Another nematode, the Ascaris mystax, has been discovered by Cobbold to be occasionally present in the alimentary canal of the human subject. The same patient and original observer, whose great work on the Entozoa does such honor to the English school of medicine, has also shown that the Strongylus bronchialis, a nematode allied closely to Strongylus micrurus,—the thread worm found often in abundance in the windpipe of the calf,—has been discovered in man. These parasites, when they are developed in the body, are also carried by food.

Guinea-worm Disease.

Dr. Spencer Cobbold opens his chapter on the Guinea worm —the Dracunculus or Filaria medinensis—with the opinion that the "fiery serpents" which afflicted "the children of Israel during their stay in the neighborhood of the Red Sea," were neither more nor less than specimens of this human parasite.

The parasite is found within certain tropical limits in Asia and Africa; and is described by Cobbold as the adult female condition of a nematode parasite, which is parasitic only during the final stages of its life period, after it has taken up its residence in the subcutaneous and intermuscular cellular tissues of man, dogs, and horses.

The parasite takes literally the form of a serpent or worm when full grown, having a head with spirules, an uniform cylindrical body, and a termination called commonly a tail. It is viviparous, and reproduces abundantly. It exists naturally in water, and, as Cobbold explains, "gains access to the human body without reference to age, sex, race, or country, the only necessary condition being that the skin be exposed to water in those localities where the Dracunculi flourish."

The parasite enters the body direct from the outer surface, not by the mouth, but by the surface of the skin, and probably by the sweat-pores. Getting into the cellular tissue it attains a great length, and has to be extracted by gently winding it out on an ivory rod or a quill. The lower limbs are the parts usually affected, and sometimes great irritation is produced by the parasite. After prolonged monsoons the disease, according to Cobbold, is not unfrequently severely endemic ; the parasite growing with considerable rapidity within the tissue of the bearer of it, and giving rise to a formidable entozootic affection to which the name of *dracontiasis* is applied.

Filarial Disease.

Another form of disease from worms of the filarial kind, is produced by the *Filaria Sanguinis Hominis*, and is one of the most curious of the affections of the human family that has ever been revealed by minute scientific research.

We are indebted to Dr. Patrick Manson for so much that has been made out on this subject that we may look upon him as the discoverer of the leading facts.

In the filarial disease the filarial embryos are found in the blood of the person affected by them, but only at certain times in the twenty-four hours. The entrance of the embryos into the blood begins some hours before the usual time for going to sleep and ends a few hours before the time for waking. In the blood this minute embryo is of snake-like appearance, having, as Manson describes it, a perfectly structureless body, enclosed in a delicate and, for the most part, closely applied tube, within which it shortens and extends itself, giving rise, from the collapse of the tube when the body is retracted at either end, to the appearance of a lash at the head and tail.

The embryos may escape from the body by the excretions, and have been detected in tears and urine. It is necessary indeed that the embryo should escape from the host which received the parent worm, in order that it may undergo further development. For this reason a man infested by these embryos is saved from death. In the dog, and in man infested with filarial embryos, Manson has calculated that there may be at one moment two millions of the embryos. If these were to begin to develop into the full-grown filarial worm, their volume, long before they had attained one-

hundredth part of the mature filaria, would occupy a space many times greater than that of the body of the animal in which they exist. They escape, therefore, from the original host.

How they escape from the person or animal in which they are found, and increase and re-infest the higher animals, is one of the most remarkable histories in the range of natural science. Where the troublesome animal called the *mosquito* exists there may the filarial disease exist, with the mosquito as the fecundator and carrier. The man infested with the embryo filaria, if bitten by the mosquito at the time when the embryos are in his blood, gives up to the mosquito some of the embryos with his blood. In the digestive apparatus of the mosquito the embryo passes through three metamorphoses into full development of the filarial worm. About the fourth or fifth day, after feeding, most mosquitoes die. Dying in water the filaria escape into it, and man using that water comes in contact, accidentally, with the parasite. The parasite may penetrate his skin, but more frequently he swallows it with the water he drinks. It finds its way through his system to its final resting-place, wherever that may be, fecundates there, and from thence yields its embryos to the blood and tissues, to appear, cease to appear, and reappear periodically.

The perfectly-developed parasite, as it is removed from the mosquito, is described by Dr. Manson as armed with a boring apparatus, toothed or saw-like, with which it cuts its way into the tissues of the higher animal or host, and out of the body of the mosquito or nurse,—the intermediate host. It is endowed with marvellous power and activity. It rushes about, forcing obstacles aside, moving indifferently at either end, and appears quite at home, and in no way inconvenienced by the water in which it has been immersed. The formidable animal, thus fully equipped for independent life, is quite ready to quit its nurse, and if man becomes its host is equally ready to take every advantage of its position, and charge him with periodically-appearing embryos in his blood.

The periodicity of the appearance of the embryos in the blood is still a puzzle. Dr. Myers, who has studied the phenomenon, has ventured the opinion that the parent worm from whence the embryos come reproduces a swarm daily, and that the product dies every day, leaving the blood free until a new swarm is given forth. To this view, in many respects very natural and reason-

able, Dr. Manson objects, and retains an opinion, which he originally formed, that the embryos, after remaining in the blood-stream for a certain number of hours, retire to some other parts of the organ or some other set of vessels. He holds that in all cases filarial embryos get into the lymphatic vessels, and that when lymph containing them, by the accident of a rupture or tear, finds its way into an excretion like the urine, the parasite is always found in the excretion. With regard to the periodicity, Dr. Stephen Mackenzie adopts a view, which was first advanced by Dr. Mortimer Granville, namely, that the said periodicity is due to some influence like that which leads to the recurrence of sleeping and waking. On the whole I conceive that Myers' hypothesis is, perhaps, the best, although it is far from conclusive.

Symptoms of Filarial Disease.

The facts relating to occurrence of Filaria in the body are sufficiently striking; but it is even more strange still to know that the parasites may actually be present in the body, and may make their periodical inroads into the blood, without giving rise to any very marked symptoms of disease. When symptoms of a persistent kind do arise from them they are those of lymphatic abscess, or of the disease of the skin called elephantoid disease,—elephantiasis. The way in which this is brought about is believed by Manson to be due to what he designates the miscarriage of the filarial worm which gives forth the progeny. Naturally, this worm gives forth her young or embryos living, and they, from their small size, $\frac{1}{3000}$ of an inch in diameter, travel with as much ease as blood corpuscles themselves. They pass through the gland structures from the lymphatic vessels, reach the thoracic duct, and get into the stream of venous blood readily. But sometimes from accident, such as the death of the parent, the ova are evolved before the embryos included in them are set at liberty. The ova having a diameter of between $\frac{1}{500}$ and $\frac{1}{750}$, they cannot pass the glandular structures so as to reach the blood. As a result they accumulate, block up the lymphatic vessels, cause enlargement of glands, and produce, by lymphatic obstruction, that disease which in the East is known as elephantoid.

The history of *Filarial Disease* is as singular in its way as that of the pearl-dust disease described at pp. 380–1 in the previous book. It is a splendid illustration of the success of careful

and painstaking inquiry in the unravelling of the phenomena of disease, and of modern facilities for physical research.

Cestode Disease.

The Cestode or tape-worms include the Tænia or ordinary tape-worms, and the Cysticerci or bladder-shaped worms,—Hydatids.

The phenomena of disease induced by the Cestode, or tape-worms, are all related to foods, and the relationship is singularly exhibitive of the success of scientific experimental research in its application to medical and sanitary science.

Tape-worm Disease.

The tape-worm is the cestode with which the community is most familiar; but it is, in fact, one only of several phases of a distinct parasitic growth. It does not enter the body as tape-worm, but is derived from a larval form which is present, usually in the encysted state, in the fleshy or visceral parts of animals that are consumed as food.

The commonest tape-worm in the human subject is the *Tænia solium*, a flat, ribbon-like worm, divided into numerous segments, and reaching sometimes a length of many feet. The longest I have seen extended to sixty feet, but some observers have spoken of a length far exceeding even that. This worm is derived from the hydatid known technically as the *Cysticercus cellulosæ.* The embryo of the Cysticercus, swallowed accidentally by an animal which is to become human food, the pig for example, enters the alimentary canal, pierces the mucous surface, migrates along the cellular or connective tissue, and becomes embedded in the inter-muscular spaces. In this position the embryo undergoes development into Cysticercus cellulosæ, and so, infesting the flesh of the animal, gives rise to that diseased condition of food commonly known as measly pork.

The measly food is the source of the tape-worm. By hooklets with which it is armed, the living Cysticercus connects itself with the wall of the bowel of him who swallows it, and sprouting, as it were, from the attachment it has made, becomes the many-segmented, long, flat tape-worm.

Hydatid Disease.

There is another side to the question of induced diseases from the cestodes. The imperfect cestode worms from which the tape-worms are developed, are, in their turn, the causes of diseases which were characterized by the old writers as hydatid diseases, and which amongst the people are still known by that general name. The *hydatid disease* originates from the tape-worm, and a simple illustration of the fact is derived from the history of parasitic disease in the inferior animals. The dog is commonly infested with the tape-worm called the *Tœnia cœnurus.* The sheep is infested with an encysted hydatid, the *Cœnurus cerebralis,* which affects its brain, and gives rise to the disease called the "staggers" or "sturdy." If a sheep be fed with tænia from a dog the cænurus will be produced in the brain of the sheep; and if a dog be fed with cænurus from a sheep the tape-worm will occur in the intestine of the dog. Experimental researches have since proved that the two forms of disease can be thus, reciprocally, induced.

The illustration extends to the human subject. A little tape-worm which is found in the dog, and is called the *Tœnia echinococcus,* yields a larval form which is cystic,—the bladder-worm, or hydatid of man, *Echinococcus Hominis.* In its embryonic state this parasite, introduced into the intestinal canal by food or water, permeates the tissues, and becomes in time encysted in one or other of the vital organs. The liver is the organ most frequently attacked, but no organ is actually free from invasion. The embryo in due course becomes developed into an easily recognizable animal form enclosed in its cyst. It has a head with a double crown of hooklets, a body containing calcareous particles, and four suckers.

Through what precise articles of food or drink embryo of the echinococcus is introduced is not yet completely known; but the experimental evidence of introduction by alimentary substances is demonstrative.

Symptoms of Cestode Disease.

The phenomena of disease caused by the cestodes are many and important. The tape-worm is a source of constant irritation, and the knowledge of its existence in the body often causes much depression.

The most dangerous forms of disease from parasites are those which follow the insertion and development of the true hydatid, the echinococcus, in the tissues and vital organs. The echinococcus, as if it had a roving commission, plants itself in the most various and important viscera. The brain, the spinal cord, the eyeball, the lungs, the liver, the intestinal glands, the kidney, the urinary bladder, the muscles, and even the cavernous portions of bone itself, are homes in which it may live.

In consultation with the late Dr. Herbert Barker of Bedford, I once saw a man who threw off the echinococcus by the renal secretion, and we traced in this instance the mode of entrance of the larvæ of the tænia.

The man had for years subsisted almost altogether on fresh pork, in so far as animal food was concerned, and twice weekly had feasted on pig's fry, a dish made up of the intestinal part of the swine. On some one of these many feasts he had, by accident, partaken of a fry containing an embryonic parasite which the swine had picked up while feeding, and which had come from the tape-worm of a dog.

Trematode or Fluke-worm Disease.

Disease from the Trematode or fluke-worms is rare in man. In sheep, the liver fluke, *Fasciola hepatica*, is, as is too well known, a cause of most serious and extensive disease, and the same parasite has, in a few instances,—not ten probably altogether,—been found in the human body. By some happy accident or necessity man has, up to this time of his history, missed the food that conveys this fatal enemy; an accident the more to be wondered at when it is known, as Cobbold truly says, that the liver of a single sheep may, at any given time, harbor several hundred specimens of the fluke, and that every mature specimen may contain many thousand minute eggs.

The fluke known as the *Distoma Hæmatobia*, or *Bilharzia Hæmatobia*—from the name of Dr. Bilhartz, its discoverer in man—is sometimes a cause of fatal disease in Egypt, Mauritius, and the Cape of Good Hope. The adult male worm is nearly half an inch long, and is broad; the female is longer but narrower than the male. The worm was first found in the portal veins of the infested subject, and the blood seems to be the seat in which it is located. Its ova make their way into the excretory

organs, as the kidney, and may be voided by the urine. They give rise to great congestion of the affected organs, to irritation, and in worst cases to extravasation of blood. The mucous membrane of the colon has been found charged with vegetative-looking growths filled with eggs of this parasite. The parasite or its ova probably finds its way into the body by means of drinking water.

Diseases from the Ectozoa.

The diseases caused by the Ectozoa, parasites affecting the outer surface of the body, are of three classes. One class is due to the presence of pediculi or lice; a second to the acarus or itch insect; a third to fungoid or vegetable parasitic growths.

Some authors divide these parasitic diseases into—

1. Diseases dependent on animal parasites:—

(*a*) Phthiriasis. Diseases from lice.

(*b*) Scabies. Disease from acarus scabei or itch insect.

2. Diseases dependent on vegetable parasites:—

(*a*) Favus, or scald head.

(*b*) Tinea tonsurans, including herpes tonsurans, sycosis, herpes circinatus, and Tinea Polonica.

(*c*) Pityriasis versicolor.

(*d*) Alopecia.

(*e*) Mycetoma, or cotton fungus disease.

Phthiriasis.

The parasites producing the diseased conditions included under the present sub-section, are of three kinds,—the *pediculis capitis*, the *pediculis pubis*, and the *pediculis corporis*. The first is the insect which is found on the hair of the head; the second on the hair of the pubes; and the third on the body. The first is smaller than the other two; the second, crab-shaped, is usually adherent to the root or base of the hair; the third is large, and moves rapidly, causing much irritation. The first never leaves the head; the second is always found where there is hair, but not on the head; the third never invades the hairy parts at all. These parasites give rise to prurigo,—itching,—and sometimes, as a consequence of irritation, they produce, indirectly, an eczema. They are promoted by uncleanliness of person, and are transmis-

sible, directly or by their eggs, from one person to another. Some persons of unhealthy constitution are affected by them with special facility.

Scabies.

The parasite called *Acarus scabei* or itch insect is one of the most definite of causes of parasitic disease. The insect burrows under the skin, and produces intense itching and irritation. The body is first infested by the female acarus, which pierces the skin to the lower layers of the epidermis and there makes its home. As it deposits its eggs it burrows still deeper, and in thirteen to fourteen days the new acarus is hatched and set free. This comes to the surface of the skin. The male insects remain on the surface, but the females after impregnation burrow into the skin, like the mothers from which they came, and thus the disease continues to be extended. The female acarus having once burrowed under the skin does not return to the surface.

The effect of the insect on the skin is to produce a painful eruption, which is often pustular at places where the skin is pierced. The irritation leads to much itching, and the friction used to relieve this symptom is a cause of further irritation. When freshly separated from one of the infested spots, the female acarus is large enough to be seen without the aid of a magnifier, and is easily seen by the help of a Codrington lens. It has a roundish body; a head armed with mouth, but not provided with eyes; and eight legs. The male insect is much smaller than the female. Some years ago Dr. Hassall discovered an acarus in some varieties of coarse sugar, and inferred, I have no doubt correctly, that the disease called grocer's itch is caused by the hand of the grocer coming into contact with the impregnated female insect from the sugar. In a case of this kind I found an acarus on the person affected, but failed to find any insect in the specimen of sugar from which the patient believed he had become affected.

The disease, scabies, is mechanically communicable, and is rarely met with except amongst very uncleanly people; but it may, by accident, be contracted by cleanly people. The flexures of joints, and the spaces between the fingers at the points where the fingers meet, are the parts most easily infested.

By very simple means the acarus scabei can be killed, and the disease it produces removed, or, as is commonly said, cured.

Diseases from the Vegetable Parasites.

Disease connected with Achorion Schönleinii.—The Achorion Schönleinii is intimately connected with the disease named Favus, described at p. 265. The parasite is a fungous growth, consisting of sporules of about $\frac{1}{3000}$ of an inch in diameter, containing, sometimes, granules; and of pointed tubes, of about $\frac{1}{800}$ of an inch in diameter.

Diseases connected with Trichophyton tonsurans and sporuloides, and with Microsporon mentagrophytes.—The parasites here named are connected with, if they be not the cause of, Tinea tonsurans,—ring-worm of the head; Sycosis; Herpes circinnatus; and, Tinea Polonica, diseases described at pp. 261--266. The parasites are composed of very minute spores and sporules, strung together but unaccompanied by tubes.

Disease connected with Microsporon furfur.—The Microsporon furfur is a vegetable sporule or spore of rounded shape, and with short branching tubes. The spores run in clusters, and adhere firmly to the epidermis or scarf-skin. The parasite is the cause of or is connected with the disease called Tinea, or Pityriasis versicolor. It produces yellow or brown spots on the surface of the affected skin.

Disease connected with the Microsporon Audouini.—The affection called alopecia areata—baldness—is attributed by some writers to the vegetable parasite, Microsporon Audouini, which is made up of minute spores and fine tubes or filaments. The spores are sometimes met with in the hair itself, producing in the hair-tube a swollen or bulbous appearance which is very characteristic.

Disease connected with Chionyphe Carteri.—Cotton Fungus Disease.

The parasite called Chionyphe Carteri is a cryptogam, which getting beneath the skin invades even the bones of persons whom it infests, and gives rise to the diseases called Mycetoma, Madura foot, and Fungus foot, described at p. 266. The three diseases, similar in character, are attended with apparently different parasites, due probably to different stages of development of one original form. The parasite exists in round firm masses of mould-like character.

In describing some of the assumed vegetable parasitic affections, I have headed the paragraphs introducing them so as to connect the parasites with the diseases in which they have been found rather than to put them forward as primary causes of the diseases. This is necessary, for the opinions of the best observers are still divided as to whether the parasites are causes, coincidences, or effects. I do not think, for my part, that they are ever first causes. They would not exist, I mean, unless the diseased conditions which favor their life had not been made for them. Viewed in this light, they become symptoms or consequences, or, at most, aggravations of disease rather than causes of it.

Diseases from the Entophyta and Epiphyta, including Algæ, Fungi, and Mycroderms.

Disease connected with Leptothrix Buccalis.—Leptothrix is an alga affecting the mouth. It has been discovered in concretions on the teeth, and on the tonsils. It is not a known cause of any serious local disease.

Disease connected with Oidium Albicans and Torula.—The filaments and spores of Oidium Albicans are always found in the eruptions of thrush in children, and are always attended with an acid secretion of the mouth, a fact which leads Dr. Leonard Sedgwick to consider the parasite as a cause of fermentative change in the mouth.

This minute parasitic vegetable growth has been assigned as a cause of other diseases. M. Collin reported to the Academy of Medicine, in the year 1864, that three persons who were cutting vines, by an accident cut themselves, and were poisoned by the oidium. They all suffered after a few days from loss of appetite, shivering, and fever. Their wounds, which originally were slight, became gangrenous, and their limbs swollen. In all of them there was "*muguet*" of the mouth, which consisted of a cryptogamous product called the "oidium" of the mouth.

That the parasitic cryptogamic oidium albicans may, by inoculation, become a cause of disease in the human subject, was an hypothesis already advanced in May, 1858, by Professor Laycock, the late distinguished professor of medicine in the University of Edinburgh, on his discovering the Oidium in a pellicle or false membrane that had formed in the throat in a case of diphtheria.

It has been inferred that disease may be taken from the use of a flour containing a similar parasitic fungus—"*Oidium aurantiacum.*" This fungus was discovered by the late Dr. Robert Dundas Thompson in a specimen of bread made from an inferior kind of flour which easily becomes acid when exposed to moisture, and which emits the well-known sour smell, even after it has been turned into bread, if it be for a short time exposed to moist air.

The spores of the *Torula Cerevisiæ* or yeast plant have been discovered in the secretions of the body, and were at one time believed to be connected with choleraic disease. The hypothesis has not been sustained.

Disease from Sarcina Ventriculi.

The parasite called Sarcina, and which is made up of a series of rods held together in square-shaped masses, has been found in the secretions of the stomach, in some excretions, and in the fluid of the ventricles of the brain. It is most commonly found in the secretions of the stomach, and hence the common name Sarcina Ventriculi. When present there it develops with great rapidity, and keeps up an incessant irritation which causes vomiting of a peculiar sour fermenting fluid. In one instance of this kind, which was under my own care, the irritation lasted for months owing to the presence of the parasite, and as the digestion of food was almost stopped death itself became imminent. At that crisis the symptoms suddenly ceased, and recovery was completed in a few weeks.

Sarcina has been detected in the fluid vomited in pyrosis or water-brash, and the late Dr. Tilbury Fox believed that he had discovered the parasite on the skin. Its precise mode of introduction into the body is not as yet understood.

Disease in Connection with Bacteria and Bacilli.

At the close of the last chapter a list is given of the various uses assigned to the terms bacteria and bacilli, and of the diseases which are assumed to spring from these parasitic organisms.

Bacterian and bacillian parasites are now found to be present, but not always present, in the secretions of many contagious diseases, and in those of some other diseases which are not ordinarily considered contagious. The reader may, therefore, turn to the

chapter on diseases which run a definite course, and attach a parasitic growth to many of them, as well as to phthisis, ague, and leprosy. I do not propose here to enter into the controversies which have arisen in relation to the presence of these organisms in the diseases named, or in regard to their position as causes or effects, because I must refer to that subject later on when treating on the causes of zymotic affections. But I add one remarkable instance of a disease attended with a bacterial parasite in the blood, as a good typical illustration.

Spirillum in Famine Fever.

In the relapsing or famine fever of India, Dr. Vandyke Carter has discovered that the vegetable unicellular parasite described as spirillum is found in the blood of the affected persons.

Respecting this fever it is admitted by Dr. Carter that no precise information was procurable as to the origin of the epidemic disease, in the Bombay Presidency, from which his observations were made. But as, in the country districts, the fever seemed to appear simultaneously with famine, he alludes to the possibility of an independent origin of the disease. Supposing that the blood spirillum in some way represents the blood poison, it becomes conceivable, he thinks, that in certain impaired states of the frame,—the result of starvation and bad hygiene,—it might originate by a spontaneous variation of the spiro-bacterium of the saliva. Or the organism might be derived from the spiro-bacterium of impure water, which in a similar impaired state of the body finds an effective entrance otherwise debarred to it under healthy states. Possibly, he adds, germs of the spirillum are commonly present, but remain inert from absence of a *nidus* in the normal blood, but which find a suitable soil for some stage or degree of their development in an impoverished blood. Such germs produced during previous illnesses might long lie dormant in the earth or a building, *e. g.* as "lasting spores" until a return of the conditions adapted to their growth; this would account for the seemingly independent origin of some fresh epidemics.

The whole of the evidence brought forward by this laborious investigator tends to show that in the epidemic he witnessed the parasite spirillum was present, as a rule, in the blood of the affected. At the same time he affords no proof that this was the primal cause of the fever, while he proves, incontestably, that

such primal cause is essentially related to poverty and famine. In a word, a certain diseased condition of the blood and tissues must be present for either fever or spirillum to be manifested. The precise part played by the parasite in the disease has yet to be demonstrated, together with the fact of its presence in all epidemic visitations of the same affection.

Disease Connected with the Parasite Actinomyces.

Recently Professor Ponfick of Breslau has described a disease which is contracted by man from the ox. The ox is attacked, sometimes, with a tumor affecting the jaw, usually the lower jaw, from which the infection is assumed to be directly or indirectly conveyed to the human subject. In the diseased person fistulous openings occur in the skin of the neck and back, ending with suppuration and phlegmon, or with pneumonia, pleurisy, or peritonitis. The discharges from the openings contain yellow millet-like seeds of fatty character resembling what is present in the ox. The millet-like seed consists of a number of small elementary bodies of Mycelium or fungus which Bollinger had found in the ox, and called actinomyces. The disease in the ox is called Actinomycosis; in man *Actinomycosis hominis*.

On the Parasitic Origin of Phthisis Pulmonalis or Consumption of the Lungs.

We have already seen that a bacillus may be found in the expectoration and in the contents and walls of cavities of the lungs of persons who are suffering from phthisis. This observation was first made by Professor Koch, and from his experiments on the communicability of symptoms of phthisis to inferior animals it has been inferred that the bacillus is the cause of this disease. The subject has excited the keenest interest in the medical world. From the controversy which has been elicited, and which I have followed with the closest attention, I gather that in the enthusiasm of the controversy, conclusions have been arrived at which are far too comprehensive to be even near the expected realization of truth.

In order to prove the origin of phthisis from the bacillus of tubercle it has been all at once assumed that phthisis is one disease. Constitutional tubercular phthisis; alcoholic phthisis, which need not be constitutional; syphilitic phthisis, and every other

variety, have been thrown into one. This is entirely opposed to the facts of experience relating to the history of the disease.

To support the speculation still further it is insisted on that the disease is always communicated from one person to another by contagion. This view is of course essential to the hypothesis. But there is no evidence that the disease is ever carried by contagion. I was for fourteen years physician to a hospital for diseases of the chest, and in the large public experience there gained, together with that obtained in private practice, I have treated over three thousand cases of the disease. In that large field of observation, extending over thirty years, I have noted no question more carefully than that which relates to contagion, and I cannot recall a single instance in which I could trace, in a clear and satisfactory manner, that the affection was communicated from one person to another.

I have known persons who were susceptible to the disease exposed to what would have been the extremest peril if there had been contagion, but have never known contagion to result under such circumstances. I have known three members of the same family die of phthisis, the first affected being in closest companionship with the others, without any communication of the disease at the time. Yet years afterwards those same persons, on the mere accident of taking cold, have contracted the disease. I never knew a nurse, a doctor, or any other attendant on the consumptive take the affection from contagion, nor anything that at all resembled such relationship.

The supporters of the bacillus hypothesis, in their anxiety to make it true, ignore the overwhelming evidence of hereditary tendency to phthisis. If all were susceptible to the disease all would take it, and the fact of taking by infection or contagion would be obvious to every observant mind. But, in truth, few if any suffer from the commonest form of consumption, that which attacks the young, except they are born with the proclivity to it. In the cases I have seen over ninety per cent. were hereditarily disposed to the malady and became stricken with it, as an all but universal rule, while living with other persons, and under the same conditions as other persons who were not affected with it.

Once more, in order to give credit to the hypothesis, the peculiar condition of body of those who suffer is practically set aside as of no moment. It is well known that they who are disposed

to consumption are of delicate build; have commonly a narrow, pointed, or pigeon-shaped chest; a feeble respiration; a delicate skeleton; and, generally, a feeble frame. We, indeed, who from practice have learned the lesson, know at once the people who are of phthisical type, and we feel sure they are in danger, independently of any exposure to special contagion.

Lastly, to make the phenomena of the disease fit in with the necessities of the hypothesis, it is suggested that a susceptible person or an unsusceptible is safe so long as he or she does not come into contact with the bacillus which excites the disease. But we who have observed the phenomena of the commencement of phthisis pulmonalis, are aware that the common excitant of the first symptoms is catarrh, or common cold, contracted, usually, when the body is exhausted from overwork, from anxiety, from fatigue, or other depressing influence. I can scarcely recall a case in which the origin of the disease was not from a cold; and the eminent physician of our time, who has lately passed from us, Sir Thomas Watson, once expressed to me when we were meeting in consultation in a case of acute tuberculosis brought on by an exposure to a severe chill, that there was no observation in medicine of which he was so assured as that of the development of phthisical disease, in the predisposed, from taking what in other persons would be simply called a cold.

To pass by all these practical facts because they do not chime in with a newly-launched hypothesis, is, I venture to submit, out of reason. No experiment that has yet been performed is in any sense the counterpart of so much experiment from experience. Moreover, experiment admits of being used in another way. In the same kind of lower animals as those in which phthisical disease is supposed to be induced by inoculation, I induced similar disease by making animals inhale an atmosphere containing vapor of nitrite of amyl. Here an effect produced directly on the nervous system and on the nutritive changes under the nervous control, was the exciting cause of the changes in the pulmonary structure; but he would be an extreme advocate of an hypothesis, who would argue thereupon that nitrite of amyl is the cause of phthisis in man, although such an hypothesis is just as rational as the germ hypothesis.

The only piece of evidence which runs practically with the hypothesis of the parasitic origin of phthisis, is that having refer-

ence to the fact of the injurious influence of close air on those who are predisposed to the disease. I have shown over and over again how easily phthisis is developed in predisposed persons who sleep in a confined and unventilated room, and I have quoted the history of the barrack-life of our household troops some years ago, and of the ravages of consumption in them when they were housed in confined and close air.

Such facts at first seem, truly, to give some countenance to the parasitic hypothesis, and if they stood alone they would be forcible if not demonstrative. As it is, they can only be taken in combination with the other facts above stated, upon which they are found to tally so completely with the constitutional and neuro-pathological theory of origin that they need no other explanation. The confined and devitalized air acting as a depressing influence on vital action favors predisposition, and enables any disturbing cause to set up the first series of nutritive changes in the lung from which the rest proceed.

On the whole, then, all that it seems to me can be honestly admitted in respect to the parasitic nature of phthisis pulmonalis, is, that in certain instances of it, perhaps in many instances of it, a vegetable parasite is found in the affected structure, and in the expectoration. But even this requires still further proof.

Summary.

The summary of what is reliably known respecting parasites as causes of disease may be placed as follows:

1. The embryos of certain parasites enter the body by the alimentary canal, remain in the canal and develop there, causing much local irritation. Example:—Lumbricus, Tænia, Ascaris.

2. The embryos of some other parasites enter by the canal, develop there, pierce the tissues, and by their presence produce irritation and various subsequent changes of disease in the tissues and organs with which they are brought into contact. Example:—Trichina Spiralis.

3. There is one parasite affecting the blood, the embryos of which appear and disappear from the blood with periodical regularity. Example:—Filaria Sanguinis.

4. There are some parasites which pierce the skin and pro-

duce disease by lodgment in the tissues. Example:—Filaria Medinensis, or Guinea-worm.

5. There are parasites which affect the outer surface through the several pores and produce specific diseases of the skin. Example:—Acarus Scabei.

6. There are some parasites which light upon the skin or its appendages and grow there, aggravating the symptoms of disease, but probably not producing disease *ab origine*. Example:—Achorion Schönleinii.

7. There are vegetable parasites, which would be placed under the College lists as of the nature of Algæ. They are the simplest forms of life, and are found in the blood, in the secretions, and in the structures of the body in numerous diseases, as in typhoid, thrush, relapsing fever, syphilis, gonorrhœa, ague, leprosy, malignant pustule, pyæmia, phthisis pulmonalis, and other diseases.

To these parasites, colorless and unicellular, the name Bacteria has been applied. They are arranged by Cohn, as already shown from Power and Sedgwick's description, as Sphærobacteria, globe-like, including Micrococcus and Sarcina; Microbacteria, rod-like; Desmobacteria, larger rod-like; Filobacteria, thread-like, including Vibrio and Bacillus; and Spirobacteria, spiral-shaped, including the Spirillum.

The most important of these simple colorless organisms, in the view of those who attach primary meaning to them as causes of disease, are the Sphærobacteria, which give the micrococcus that has been observed in some of the contagious diseases and in silk-worm disease; the Desmo- and Filobacteria yielding the bacilli, which, as we have seen, are found in anthrax, tubercle, and malarial fever; and the Spirobacteria which yields the Spirillum, discovered by Carter, in relapsing fever. There may also be added as belonging to the vegetable parasites, the fungus which is met with in mycetoma, Madura foot, or fungus foot disease.

To this summary I have the privilege of adding the following brief notes, on the question of the probable derivation of the vegetable parasites, from the pen of a microscopical observer, Dr. Braxton Hicks, who of all men has been most minute and impartial in investigation:

"(*a*) The vegetable parasites on the human body are mostly of the *fungus*, rarely of the *algæ*, tribe.

"(*b*) Both have many modes of growth or different phases of

existence, so that when we come upon one mode, we have but slight knowledge of the total of the plant.

"(*c*) Bacteria, for example, is only one phase. If it is of fungus origin then also we must look in other directions for the other phases.

"(*d*) If, for instance, one looked in other parts of the body for that supposed to be the cause of phthisis we should expect to be disappointed; in other parts one would expect to find some other phase—*e.g.* mycelium.

"(*e*) Specimens exhibited from lung structure in phthisis seem sometimes to be clearly a form of 'Binary segmentation' of some fungus. The fungus might in that situation go on multiplying in that form till some general change of the condition of the system or lung occurred; then it might alter its mode and continue in the altered state until another change occurred.

"(*f*) It may be inferred that these parasites are fungi rather than algæ, because algæ like light. The lung cavities are suitable to fungi, and low states of health favor fungus growths.

"(*g*) Hence it is exceedingly difficult to say whether, supposing the lung cavities to be filled with these segmentating cells, they are the cause of phthisis or the accidental condition.

"(*h*) The same remarks apply to all diseases of Bacterial origin, —I mean till observation and experiments have proved that the introduction of a specific Bacteria reproduces the growth and accompanying disease."

In this review of the parasitic origin of disease, I have kept closely to the diseases of the human subject, and have avoided reference, except in the most incidental manner, to those human diseases which are supposed to be of zymotic origin, and which are believed by many to be excited by parasites acting as ferments. To the last-named topic attention will be directed in the chapter which immediately follows.

CHAPTER VIII.

ZYMOSIS OR FERMENT AS A CAUSE OF DISEASE.

I ENTER in this chapter on one of the most debatable subjects in the whole range of medical science; I mean the part played by the process of zymosis or fermentation in the production of disease.

The idea of fermentation as a cause of disease is very old. At various times it has been held up as the origin of all diseases which run a definite course, and which seem to be communicable from one person to another. At other times it has subsided as an hypothesis almost altogether. When, in fact, the theory of disease being dependent on changes in the secretions or humors and in the blood from which the secretions come,—a theory designated the *humoral pathology*,—has been prevalent, then the zymotic hypothesis has prevailed. When the theory of diseases being due to nervous impressions and to aberrations in nervous functions,—a theory designated the *neuro-pathology*,—has been in the ascendant, then the zymotic hypothesis has all but passed away.

The works of Thomas Willis, of Van Helmont, of Becher, of Stahl, did much during the two last centuries to support the humoral pathology. The labors of Hartley and Erasmus Darwin in the last century, and of Bichat at the close of that century, with those of Charles Bell, Walker, Gall and Spurzheim, Prochaska, and Marshall Hall in the present, did as much to support the neuro-pathology. These two theories have been specially reflected in theorizing studies on the origins of disease. After Willis's great book on fermentation all the contagious diseases were thought to be of zymotic origin, and the hypothesis will be found recorded, for a long period of time, as if it were proven. If the reader will turn to a book published so lately as 1835, Sir Richard Phillips's "Million of Facts," he will find the word contagion thus commented on at p. 123.

"Contagion is one of those generic words which, like attraction, bewitching, suction, mislead and obstruct inquiry. The differences about it among the faculty are intellectual phenomena. Is not contagion, says Dr. Dwight, such a fermentation of an animal body as generates animalculæ, and, hence, the danger of contact; and is not exemption, after affection, evidence that the germs in that subject have been exhausted? Do we not subsist on such germs, and is not the class of contagious diseases evidence that they have overcome the usual economy of the subject? The separation of animalculæ in our microscopic experiments prove the universality and indestructibility of their seeds or germs."

In the present day the tendency is again all towards the humoral pathology, and so strong has this tendency set in that the hypothesis of disease from fermentative changes is once more in full tide. In the force of this current of opinion it is, in fact, very difficult to steer safely. It carries those who are upon it away from all old landmarks and soundings. Nervous phenomena are ignored altogether, and the nervous system itself is almost forgotten. Hereditary proclivities to disease are treated as of little moment, or are discredited. In a word, nothing is required to account for the symptoms of any disease except a germ to excite some kind of fermentation indicated by symptoms which, in reality or in imagination, may be due to a process resembling fermentation.

The extreme advocates of the zymotic interpretation of disease hardly see, and hardly, it is plain, care to see, to what results their unchecked course is carrying them. If they wish to be authors of an instauration founded on demonstration, they must go to the complete proof that the continuance of life itself is by a germ derived from without by every animal that propagates its species. It must not merely be so many germs so many diseases, but also so many germs so many animals; and the germs of animals, not less than of diseases, must be floating in the air,—invisible, but there.

I shall endeavor in this chapter to avoid the extreme views which I have here described. I shall try to put the facts we have, up to this time, in hand in their fair and legitimate position, and having done this, I shall leave the matter to the judgment of the reader.

In following out the plan thus declared it will be best for me

to present an outline of the subject in so far as there is a concurrence of opinion amongst reasoning scholars, and amongst those who have studied the natural history of disease rather than natural history pure and simple. Thus placed, the following may be accepted as common subjects of agreement.

I.

Among the many diseases affecting mankind there is a limited number which may, from certain points of analogy, be placed in the zymotic group, and be commonly called zymotic affections. These diseases are as follows:

Plague.	Dengue.
Cholera.	Gonorrhœa.
Malignant pustule.	Relapsing or Famine fever.
Scarlet fever.	Variola—Small-pox.
Diphtheria.	Vaccinia—Cow-pox.
Influenza.	Varicella—Chicken-pox.
Pertussis.	Measles.
Puerperal fever.	Rotheln.
Pyæmia.	Typhus.
Carbuncle.	Typhoid
Glanders.	Mumps.
Erysipelas.	Malarial fever.
Farcy.	Syphilis.
Grease.	Hydrophobia.

To the above list some others may be added, regarding the nature of which there would not be the same unanimity of opinion. These are :—

Catarrh.	Remittent fever.
Quinsy.	Intermittent fever.
Croup.	Choleraic diarrhœa.
Hospital gangrene.	Dysentery.
Sloughing phagedæna.	Cerebro-spinal fever.
Phagedæna.	Rheumatic fever.

II.

The diseases of the first of these groups, about which there is fair unanimity, are marked by certain stages which have already been described (pp. 44–58). To us now, as bearing on cause,

the first stage is the one that is of most importance. This stage is called the stage of *incubation*, and is that which intervenes between the reception of the promoting agent and the first manifestations or symptoms of its action.

To Dr. Squire we are specially indebted for the correct knowledge we now possess on the periods of incubation, and in the subjoined passages I offer, practically, his description. The periods of incubation are placed under five heads, according to the number of days demanded for incubation by each particular form of disease. The diseases are thus arranged into those of shortest, of short, of medium, of long, and of longest incubation.

Shortest.

a. Diseases of Shortest Period of Incubation—1 to 4 days.—Malignant cholera. Malignant pustule. Plague. Catarrh. Dissection wound disease.

Short.

b. Diseases of Short Periods—2 to 6 days.—Scarlet fever. Diphtheria. Dengue. Erysipelas. Yellow fever. Pyæmia. Influenza. Pertussis. Glanders. Farcy. Grease. Croup. Puerperal fever.

Medium.

c. Diseases of Medium Periods—5 to 8 days.—Relapsing fever. Gonorrhœa. Vaccinia. Inoculated small-pox.

Long.

d. Diseases of Long Periods—10 to 15 days.—Natural small-pox. Varicella. Measles. Rotheln. Typhus. Typhoid. Mumps. Malarial fever.

Longest.

e. Diseases of Longest Periods—40 days or more.—Syphilis. Hydrophobia.

Accepting these as the truest expression of knowledge up to the present time, we have still much to learn. We exclude in the list several diseases which probably have some stage of incubation, and we are obliged to grant exceptions in respect to those that admit of being classed together.

The diseases of the first group are fairly steady in respect to incubation, but a question may be raised by some as whether catarrh, either superficial or deep,—cellular,—should be classed amongst the zymotic diseases.

Of the diseases of the second or third group, exceptions may be adduced in which the disease may, in particular cases, have a shorter incubation than is assigned in the classification. Such exceptions must be admitted, and a case of scarlet fever, quoted by Murchison, shows for this disease, occasionally, a very brief incubation,—six hours at longest.

The diseases of the third and fourth groups will be accepted as fairly steady. Relapsing fever, as I knew it in 1847, had a longer period than five days of incubation, but *by inoculation* it is said to have five days.

In the last group syphilis will be accepted as having the long incubation of forty days; but hydrophobia is the most difficult disease to define. It may have a few days of incubation only; it may have months or even years.

III.

The agents which are capable of exciting the zymotic diseases, and of acting during the periods of incubation, are organic substances, either living or dead. In the doubt which still remains as to the vitality of these agents, they may be called organic disease-producing *particles*.

IV.

It is pretty generally assumed that the *particle* is special for each special disease. To the particles, therefore, the term *specificity* in respect to their action may be applied. In other words, one particle will not produce two diseases. Some exceptions may, however, be taken to this rule. There is some evidence in favor of the view that the particle of scarlet fever may produce child-bed fever.

V.

It is assumed by most observers that the particular organic causes of the zymotic diseases may be received into the body by all the surfaces that can absorb them. They may be received by a wound,—inoculation; by the air in breathing,—inhalation; by the alimentary surface,—fluid absorption. At the same time each poison is not receivable by the same surface. Some which act quickly when inoculated do not act if taken into the stomach as food is taken. But if a special disease-producing particle will

effect action through more than one surface, it is found to be most prompt in action when it is introduced into the body by inoculation. Thus the period of incubation in the disease small-pox is shortened when the poisonous particle which causes it is inoculated into the susceptible body.

VI.

In order for the specific disease-producing particle to exert its action, it must have a susceptible subject on which to operate. A community or a person is, therefore, defined as susceptible or insusceptible to the poisonous or zymotic influence. As a rule also to which, nevertheless, there are many exceptions, persons who have once been affected by a specific zymotic particle are, for a time, insusceptible to a second action of the same. Such persons are said to be protected, or under immunity, from the disease. The protection, however, does not last necessarily all through life. Many persons who are protected through a course of years, become again susceptible, and though, as a rule, these are subjected to a milder attack than would occur if they contracted the disease for the first time, they are not always so fortunate, for it occasionally happens that a second attack is as severe as the first, and that such an attack ends fatally.

It is pretty generally agreed upon that there are some peculiar conditions of the body during which there is extra susceptibility to the action of the infecting particles of disease. Thus women during childbirth are specially susceptible to erysipelas and to scarlet fever.

VII.

In some instances the attack of a mild form of disease acts as a preventative to, or protection against, a severer form of a similar disease. Thus the mild form of scarlet fever, called commonly scarlatina, is probably a protection against the severer forms of scarlet fever; more distinctly still the mild form of small-pox, called cow-pox, is a protection to the severer disease small-pox.

VIII.

The specific causes of the zymotic diseases, the specific infecting organic particles, travel, under certain conditions, from one

place to another. Some travel in solid form, like the fine dusts seen in the sunbeam, and with which dusts they commingle. Others appear to approach the physical quality of a vapor, and are probably carried in the air with the vapor of water. The first are wafted, the second are diffused.

The particles which travel most readily in the solid form are those of small-pox, scarlet fever, measles, typhoid, erysipelas, ophthalmia, hospital fever, ague, and cholera. The organic materials which travel in or on vapor are, probably, those which produce typhus and diphtheria.

In respect to some of the disease-producing particles it seems essential that the infecting organic substance should come into direct contact with an absorbing surface, or with the blood. The affection of hydrophobia is an illustration in point, the infecting substance having to be inoculated.

There is evidence of a circumstantial if not demonstrative character, that the infecting particles of certain diseases may travel through food or water, and may produce disease by being swallowed accidentally. Typhoid, cholera, and, some think, diphtheria are diseases that may be contracted by this method of communication.

The infecting particles, which are of solid character, seem to have the property of adhering to articles of clothing or to other substances, and are, presumably, carried by this means.

IX.

The organic infecting particles possess under favoring circumstances the power to act for long periods of time, when they are dried and kept dry, or when they are locked up by cold. The virus of small-pox and cow-pox affords illustration of this truth. The virus can be retained in the fluid or dried form for many months, or even years. Exposure to moisture for a long time, or a certain extreme degree of dilution of the infecting particle in water, destroys the power of the virus, probably by causing its decomposition.

Exposure to a high degree of heat also destroys the power of the virus. Exposure to sunlight for a long period has, probably, the same effect.

X.

Susceptibility to the action of the virus of any of the zymotic diseases is always the primary factor; and in the susceptible the presence of a minute particle of infection may be as potent as a more concentrated portion. In other words, the extent to which the infected body is influenced depends more on its own condition or state than on the amount of infecting matter to which it has been subjected. Thus a mere point of small-pox virus will produce the disease in a susceptible person, while the amount many times multiplied would not affect one who was insusceptible. In this respect the organic virus differs entirely from an inorganic poison, which, as a rule, injures in proportion to the quantity in which it is received into the body, irrespective of susceptibility or insusceptibility.

It is naturally inferred from these facts that the zymotic virus, when taken into the body of those who are susceptible to its action, either undergoes multiplication by living growth, during the period of incubation, or, by its presence, transforms something else within the body into its own virulent nature and character.

XI.

It seems to be a true reading of the natural phenomena of the diseases called zymotic, that those diseases of the class which have a short period of incubation have a prolonged period of convalescence, and remain for a long time as sources of further communication of disease from the affected; while the diseases which show a long incubation give a quicker convalescence and a more rapid freedom from danger, as sources of communication.

XII.

It is generally admitted that external surrounding conditions modify the course, intensity, and result of the diseases of the zymotic class. Each disease, for instance, seems to have its favorable season for development, and many have assumed that what is called an atmospherical epidemic influence is essential for the origin and spread of all the epidemic affections. The more reasonable and now more commonly accepted view is that these affections will spread in a susceptible community under all conditions,

but that they will spread with much more virulence, and be attended with a much higher mortality, under some atmospherical conditions than under others. A reference back to the diseases incident to particular seasons (pp. 531–545) will make this important point sufficiently clear.

In these twelve sections I have endeavored to epitomize the views which are held by, I think I may say, all scholars who have inquired with due care and labor into the nature of the diseases which are called zymotic. I must now briefly pass from what is common agreement to what is often disagreement; from practical assent to disputed theory or hypothesis.

Theories and Hypotheses on Zymotic Disease.

Before entering into the description of the theories or hypotheses as to mode of origin of zymosis,—or fermentation,—within the body, it is necessary to consider some points relating to zymosis itself.

I would begin by repeating a view which I advanced in 1861 in my "Clinical History of Scarlet Fever," that zymosis, instead of being a process foreign to the body, is, in truth, a natural act always going on and essential to life. I see no reason whatever now to alter that view. The food which we take into our bodies is the pabulum which undergoes fermentation. There is a substance or principle in the blood corpuscles, or in the fibrinous material, which in the presence of oxygen, derived through respiration, has the property of setting up natural zymosis. The result of this natural zymosis is the regular production of animal heat and of the ultimate products of animal decomposition, viz., water and carbonic dioxide. This I should call perfected animal zymosis.

If this be true, then zymotic diseases, so called, are, as a class, mere symptoms of aberration from a natural state of life, which is, in fact, nothing more than the history of all natural disease.

The action of an organic particle or virus entering from an infected organism into a healthy organism is, then, rather to modify or render imperfect the natural zymosis of the healthy organism than to excite a primitive zymosis.

How for it is true that a modified zymosis or fermentation does take place in affected bodies is still a matter of inference

rather than of demonstration. At the same time the inference is without doubt exceedingly fair and reasonable. It is not demonstrable as applied to every so-called zymotic disease, because the results of zymosis are not present in every such disease. One result of zymosis is production of heat, and it is admitted that most of the zymotic diseases are attended with increase of heat. But some are not so attended. Malignant cholera, for example, is accompanied by a decrease of temperature even to extreme coldness until the stage of reaction from collapse has set in. Cholera, therefore, might be excepted as a zymotic affection.

Ordinary zymosis is attended with production of organic acids other than carbonic, such as lactic, acetic, formic. But in many of the zymotic diseases, indeed in the majority, these secondary products have not been detectable. Other results of zymosis out of the body are those of putrefactive change ; but every physician knows that in the vast number of so-called zymotic diseases putrefaction does not occur until after death, and that it does occur whatever be the mode of death, zymotic or other.

Such evidences as these qualify greatly the absolute speculation of the zymotic origin of what are classified zymotic maladies, and would go far to upset the speculation altogether, were there not some other and counterbalancing testimonies of its truth, which are of the following character.

There is one particular disease, acute rheumatic fever, which carries out the zymotic hypothesis in the most striking manner. In that disease—which, by the way, some exclude from the zymotic class altogether—there is not only increase of temperature, but an acid product, lactic acid, identical with that which is obtainable by one form of fermentation—fermentation of milk. Still more, this affection is sometimes lighted up by another zymotic disease, notably by scarlet fever. Rheumatic fever fails, however, to represent a zymotic disease when it is in its pure and simple form, because it does not yield an organic product which will, by transmission, excite the same disease in another person. But scarlet fever does yield such a product, and therefore *rheumatic scarlet fever* offers all the conditions of a true fermentation in a complex yet specific disease.

Again, some other affections, like small-pox, and like yellow fever in certain of its forms, and like typhus in certain of its forms, are capable of yielding the phenomena of putrefactive fer-

mentation, and this may perhaps be extended to malignant pustule.

On the whole, therefore, we may accept the zymotic hypothesis of the cause of the diseases now under consideration as the best, and most probable.

In explanation of the zymotic theory in relation to mode of origin, that is to say, in relation to the mode in which the healthy zymosis of the body is modified, or a new zymosis set up in the body, there are three hypotheses.

To these I would assign the following names:—

1. The *parasitic hypothesis*, which traces the phenomena of zymosis to the introduction into the body of a parasite of the vegetable kind, like Bacteria, Bacillus, or Spirillum.

2. The *vital germ hypothesis* of Dr. Lionel Beale, which traces the zymosis to a diseased living germ produced in the body inself.

3. The *nervous hpyothesis*, which I have ventured to originate, and which traces the zymotic affections to diseased secretions produced under nervous derangement in the body itself.

The Vegetable Parasitic Hypothesis.

The strongest evidence in favor of the origin of zymotic diseases from living parasitic cells or germs is derived from analogy; and, indeed, we may say that the hypothesis rests, considerably, upon analogy. What that analogy is has been admirably stated by Dr. John Dougall of Glasgow, and as he is an opponent of the hypothesis, I select his description, as being free from bias in its favor. "Zymotic poison," he says, "in no way resembles any other toxic substance, excepting that it is a 'a deadly poison.' It differs, on the other hand, from all other such bodies, in respect that it cannot be confined in stoppered bottles, measured in minims, nor weighed in grains; and, in particular, it differs in this important point, that, while the actions of other poisons are confined to the individual affected, it renders the person it poisons poisonous.

"For example, one may attend closely on a patient suffering from a fatal dose of opium or strychnia without danger of becoming narcotized or tetanized by the opium or strychnia which the patient has swallowed. But one who has not suffered the special form of zymotic poisoning with which a person is affected could

not attend him with impunity, because he might poison his attendant, his nurse, or doctor, nay, even his friends or neighbors in the same house, with the identical virus by which he himself is poisoned. This body is, for the time being, an alembic in which a special virus is elaborating and multiplying enormously by an apparent destructive distillation of the blood and secretions, so that the tissues may literally be soaked and the body enveloped in an atmosphere of virulent infection. The blood, saliva, breath, sweat, urine, fæces, and epidermis may all be saturated with it.

"This poison is named from the Greek word *ζύμη*, or leaven, and a person under its influence is held to be in a condition of zymosis or fermentation. It was so denominated because, when it enters the blood of an individual susceptible to its influence, it gives rise to phenomena very analogous to those caused by the addition of yeast to a substance capable of fermentative change. Supposing, for example, there is added to an aqueous solution of honey, or of grape or other sweet fruit juice, a single cell of the yeast plant, *torula cerevisiæ.* This speck of matter is about the size of a human red blood corpuscle, and hence only visible under the microscope. Supposing, further, that this solution is kept at a temperature of about 70° Fahr., then in a few hours, or at most a day or two, from the single yeast cell millions are produced, so as to make the liquid turbid, and form a frothy scum at the top, and a sediment at the bottom. During these changes the temperature of the fluid is increased, and carbonic anhydride largely evolved, until latterly the heat begins to return to the normal, and the evolution of gas to cease, when the solution is found to have lost its sweet taste, and to be changed into a mixture of alcohol and water incapable of further fermentation.

"Now for the analogy between this process and that of zymotic poisoning. Supposing I were to wet the point of a needle with lymph from the body of a small-pox patient, and push it under the skin of a person who had neither been vaccinated nor suffered from small-pox; then, a thousand chances to one, that in a few days, the recipient of the lymph feels out of sorts, has nausea, vomiting, headache, thirst, back-ache, a high pulse, and hot skin. In about three days afterwards a papular eruption appears on his body, which soon changes into small blebs or vesicles. These vesicles may be few or many, separate or confluent, but

the clear and apparently homogeneous fluid which they contain has the identical specific infective nature as that with which the needle was wetted, the minute portion on the needle having now multiplied to an enormous extent in the blood of the person inoculated.

"I need scarcely say that the symptoms enumerated are those of small-pox, and that the lymph introduced into the blood by the needle is zymotic poison.

"The putting of the yeast cell into the sweet solution, and of the minute portion of small-pox lymph into the human body, are both cases of pure infection, and the zymotic phenomena evoked thereby are almost perfectly analogous.

"For, observe—1st. That the saccharine solution was susceptible to the action of the yeast, and the human blood to that of the lymph. 2d. The extremely minute portions of yeast and of lymph employed. 3d. The rise of temperature in both cases: the sweet solution becoming abnormally warm; the small-pox patient highly fevered. 4th. The great multiplication of yeast in the sweet solution, and of small-pox lymph in the blood. 5th. The yeast frothing to the surface of the fluid, and the small-pox eruption forming lymph bubbles or vesicles on the skin. 6th. Both are infectious: a cell of the new yeast would cause fermentation in a susceptible fluid; a speck of the new lymph would cause the small-pox in a susceptible person. 7th. The sweet solution is no longer capable of fermentation, owing to the chemical change it has undergone in fermenting; the small-pox is no longer susceptible to small-pox, also from some chemical change produced in the body by that poison. 8th. The sweet solution will ferment, as it were, spontaneously, that is, without putting yeast cells into it intentionally, because such cells are constantly floating about, and fall on its surface; so a person may take small-pox spontaneously, by inhaling air containing that specific poison. These are both cases of pure infection, though in neither is the infecting agent visible."

Following up this exposition in practice, the advocates of the hypothesis now under consideration contend that all the contagious diseases which run a regular course, and which, being passed through, leave the person who has been invaded safe from a further attack, depend on a vegetable organism. Dr. Thudichum, with his usual facility of fixing what he says on the mind, in-

cludes the whole hypothesis of contagious disease above defined under the name of "*vegetable parasitism.*"

If this hypothesis could be carried out with the unanimity of simplicity which its promoters wish for it, it would indeed be a happy solution to the whole of the difficulty. Each vegetable parasite possesses, they think, the power of exciting in the body into which it is introduced a fermentation, upon which special symptoms of disease are manifested. So the particular disease is made. But the vegetable parasite is itself a living contagion, and finding its proper pabulum, is reproduced, to be cast off by various secretions and to set up further and similar disease in all persons susceptible to its influence.

To sum up. The hypothesis supposes:

First, that there are as many vegetable parasites capable of setting up the special diseases as there are zymotic diseases.

Secondly, that in every susceptible person there are as many pabulums for the support of the various vegetable parasites capable of producing a specific zymosis as there are zymotic diseases.

Thirdly, the hypothesis endeavors to explain the reason of immunity from second attacks. It suggests that the pabulum on which the vegetable germ was reproduced in the body having become exhausted, the disease ceases if the patient lives, and that the protection is due to the fact that the pabulum necessary is not, as a rule, formed in the same body a second time.

The Vital Germ Hypothesis.

The author of the vital germ hypothesis, one of the most illustrious of the original thinkers and workers of this day, Dr. Lionel Beale, supports his views in the following manner.

He argues that in the body during life there are two conditions of matter: one living, the other dead. The living matter he calls *bioplasm*, the dead matter *formed material.* Every tissue, intercellular substance, and matter resulting from changes in the cells are formed from bioplasm.

He shows that masses of bioplasm after reaching a certain size, usually less than one-thousandth of an inch in diameter, undergo division, and that as soon as any mass of bioplasm has attained a certain definite size it divides, that portions move away and at length detach themselves from it. If the bioplasm were to con-

tinue to grow, the distance to be traversed by the nutrient matter, or pabulum, before the inmost parts were reached would soon become so great that these would be practically beyond reach, and could not be nourished or subjected to the constant action of currents of fluid. Death would begin in the central part of such a mass, and would soon involve particle after particle, as its ravages extended outwards, until the whole of the living mass was dead,—a most improbable order of events.

Respecting bioplasm, or living matter, the distinguished author says that it is clear, colorless, structureless, soft, and when growing quickly almost diffluent. It is enclosed in a capsule of equally colorless formed material, which, however, is firm and sometimes even hard. When this simple organism is nourished, nutrient pabulum dissolved in water permeates the capsule of formed material, and comes into contact with the bioplasm within. The non-living matter then undergoes changes most wonderful, in the course of which it acquires the same properties and powers as the bioplasm, already existing, possesses. Thus under favorable circumstances the particle grows and separates into two or more parts, which move away, and through which the process is continued.

These are vital actions differing absolutely from any actions known to occur in any kind of non-living matter whatever. They cannot be imitated, and no actions known can be fairly said to exhibit any true analogy with them. These vital phenomena do not characterize the formed material, for the production of this is coincident with the death of the bioplasm. As the formed material is produced bioplasm ceases to live, and no kind of formed material can *grow* and transform matter and direct its forces as living matter is known to do.

Of *bacterium*, Beale shows that its living matter is, probably, the lowest, simplest form of bioplasm in nature. He has figured some bacteria less than the one ten-thousandth of an inch in diameter, while the germs from which the little particles spring are far more minute. It would be difficult to say where bacteria germs do not exist. In air, in water, in the soil, adhering to tiny particles of every kind ; in every region of the earth, from the poles to the equator, they are to be found. At all periods of the year they retain their vitality. Extreme dryness does not destroy them, and they withstand a temperature far below freezing point.

Under adverse circumstances they remain dormant, and are not destroyed by a degree of heat which is fatal, probably, to every other living organism.

In the substance of the tissues, in the cells of almost all plants, and in the interstices and tissues of many animals, bacteria germs exist, and no part of the body of man and of the higher animals is entirely destitute of particles which, under favorable circumstances, develop into bacteria. Upon the skin and upon the surface of mucous membranes they exist in profusion, and they abound in the mouth and in the follicles and glands. Changes in the process of digestion are soon followed by the multiplication of bacteria in every part of the alimentary canal, and within a few hours countless millions may be developed. They multiply in the secretions, under certain circumstances, almost as soon as these are formed, and the germs exist even in healthy blood. In the very substance of some cells he has seen them, and in many cases, in which little granules have been discerned in connection with bioplasts, there is reason to believe that some of them are really bacteria germs, passive as long as the higher life is maintained in its integrity, but ready to grow and multiply the instant a change favorable to them and adverse to us shall occur.

As the germs of bacteria are found in healthy tissues and organisms, and grow and develop into bacteria when disintegration and decay occur, we need not be surprised at their existence in disease. Bacteria prey upon morbid structures, and upon the substances resulting from the death of morbid bioplasm. They are found in great numbers among pus corpuscles which have ceased to live, and they grow and multiply with great rapidity in fluids which contain disease germs as soon as these begin to lose their specific powers and to undergo decomposition. In the tissues and fluids of the body altered by fevers they are abundant, and exist, as is well known, in many instances during life. In the evacuations of cholera, and not only of cholera, they are very numerous, and in the columnar epithelium of the small intestine many have been found. In all parts of the bodies, in the fluids and amongst the solid tissues of animals destroyed by cattle plague, bacteria are present in varying number.

Turning from this physiological definition of bioplasm or living matter, Beale is led to look upon the changes and degradation

of bioplasm as causes of disease. Increased growth, owing to an increased access of nutrient pabulum, is the first change that occurs in inflammation, and is essential to the inflammatory process. From every form of bioplasm in the body pus or matter may in all probability be produced by descent from some form of normal bioplasm of the body. The pus corpuscle is bioplasm which has been so produced. Bioplasm always tends to grow. It must grow if it be supplied with nutriment; but it has within itself no power of regulating or controlling its own growth.

Touching upon the origin of contagious disease, the author dwells on the loss of formative power, which occurs as the rate of growth and multiplication of bioplasm increase. Every particle of bioplasm which might have taken part in tissue formation will, if it grows and multiplies too fast, not only lose its power of forming tissue, but the particles that may be produced from it, by descent, never regain the wonderful capacity that has been lost. But although formative power is lost, new powers or properties may be, nevertheless, acquired. These are remarkable for destruction, never for construction. Some forms of pus acquire during their production the most wonderful capacity for rapidly growing and multiplying, as well as for living and resisting the influence of external conditions. The little offsets or particles that are detached from them may rise in the air, live for a time in water or milk, or other fluids containing organic matter, adhere to a sponge or probe or other substance, or be carried in the living state on the foot of a fly or some other insect, and thus be transported to an organism at a distance from the one which was the seat of their production. The minute germs, being in contact with material adapted for their nourishment, rapidly grow and multiply in their new situation. Such forms of virus have been produced *ab initio*, fostered and propagated to the destruction of hundreds of human beings.

Thus, according to Beale, the phenomena connected with contagious animal virus are due to a minute particle of living bioplasm produced, by descent, from the natural bioplasm of the body. "This particle of deteriorated bioplasm, which in some cases may be *seen*, is a 'diseased germ,' and of these 'contagium' consists." The contagious bioplasm results from natural bioplasm, the life of which has been carried on, for some time, under unusual conditions.

An ordinary form of diseased bioplasm, pus, often originates in the bioplasm of epithelium and in that of connective tissue, and certain forms of pus have specific virulent properties, are, in fact, animal poisons which may be inoculated. The author of the living germ hypothesis does not, however, entertain the opinion that all contagious diseased germs spring from the bioplasm of epithelium or connective tissue. Some may come from white blood corpuscles. But he considers that the contagious particles concerned in propagating many of the most serious specific fevers have been derived from the living matter of man's body, and that they are not germs of fungi or bacteria of any kind whatever. Indeed in certain instances they may be seen in far greater multitudes in the tissues of the diseased organism than bacteria, which latter, as is well known, are found often enough in countless multitudes in cases in which there is no specific disease of any kind.

In these few pages I have, I hope, condensed in a clear form the living germ hypothesis of Beale. It differs, it will be seen, from the previous hypothesis, that while it traces the changes of phenomena which mark the zymotic disease to a living particle or germ as the primary cause of those changes, it derives the particle from an affected body itself, in the first instance, and traces the continuance of the disease-producing particle from such body instead of from the parasitic vegetable world.

The Nervous or Neuro Hypothesis.

When, at the commencement of the Registrar-General's Reports, Dr. William Farr formularized the list of diseases belonging to the zymotic class, the view started by Liebig of the cause of zymosis or fermentation was the accepted view. Liebig suggested that in organic nature there were certain bodies which are capable of undergoing fermentation, and other bodies which, by their presence, are capable of exciting fermentation. The substances which can ferment are of amylaceous or saccharine nature, and the substances which excite fermentation are of albuminous or nitrogenous nature. Thus, in the illustration which was given a few pages back, from Dr. Dougall, the sweet solution, which was referred to as undergoing fermentation on the addition to it of yeast, was said to ferment in consequence of contact with the

yeast, which is a nitrogenous substance. The torulæ, or living things in the yeast, were, it was known, there, and the fact of the increased growth of the torulæ during the process of fermentation was also known. But it was considered that the living thing was merely an attendant thing, and that the increased growth of the living thing was resultant, not causative, coincident, not essential. It was thereupon assumed, very naturally, that changes either resembling fermentation, or really fermentative, might take place without any connection at all with living germs or living particles, whenever nitrogenous matter in decomposition came into contact with fluids susceptible of fermentation.

When the hypothesis of zymosis in relation to disease came under consideration, this view of Liebig, as to the cause of ordinary fermentation, was taken as explanatory of the general process in the affections designated zymotic. The material which passed from the infected persons, the contagium, was assumed to be a virus or poison of a nitrogenous character possessing the property, when it was absorbed by a person who was susceptible to its influence, of promoting a specific fermentation and a specific disease in that susceptible person, with more of the specific virus itself. Thus each disease produced its own specific ferment.

As a student of this physical reading of zymosis, I conducted between the years 1856 and 1863 a long series of experimental inquiries as to the propagation of disease, from one animal to another animal, by the inoculation of the secretions of an affected animal into a healthy. I lighted in this manner upon many curious facts.

I found that disease could be transmitted from animal to animal by inoculation of various secretions, and, in addition, I learned that the secretion became more and more actively virulent as it became derivable from new stocks of infected animals, *i.e.*, the virus increased in intensity of action by passing through and affecting an animal body.

Again, I found that the virus or infecting secretion would not only act as a virus by being directly inoculated into the body of the susceptible animal, but that it could be transformed into an alkaloidal substance, when it would still continue to produce the specific effects. Some fluid drawn from a wound in a patient under the care of Mr. Spencer Wells,—fluid which during surgical fever had been excreted into the peritoneal cavity,—afforded

a virus which I reduced to the alkaloidal state in the form of a crystalline alkaloidal salt. A solution of this salt gave rise, when it was inoculated into a susceptible animal, to the most distinct form of disease of specific febrile character, and the secretions of the infected animal reproduced, by inoculation, the same type of disease in other susceptible animals. In the end I came to the conclusion that any secretion of the living body might be charged with a poisonous substance which was capable of acting as a contagium. To this hypothetical substance I gave the name of *septine*, and I called the diseases induced by a septine, *septinous* diseases.

As the inquiries which led up to the experiments with septine progressed, I was led to form a view as to the nature of the poisonous base and as to its mode of origin. As I have already said, it seemed to me to be an alkaloid, or chemical substance, resembling, in physical properties, morphine, strychnine, and other bodies of that class, derived, not like them from vegetable but from animal organic matter. The difficulty in assuring this lay in finding a reason for the various effects of the septinous material. If it were a common base like that which I suspected I had found, why should it not always produce the same form of septinous disease? Why should it, on the other hand, produce, as virus does, many kinds of disease, each having a certain general likeness to the others, but each at the same time different in many important details, as different, for example, as small-pox is from scarlet fever, or measles from hydrophobia.

The difficulty, in this way suggested, led me to reflect on the connection which might exist between the bases of the different secretions of the animal body and the matter I had called septine. Each secretion yields some organic product; the gastric secretion pepsine, the salivary secretion ptyaline, and so on; and each secretion plays a different part in function, although the organic bases of them all may present a general similitude of construction.

Thereupon I was led to the conception that the secretions of the animal body are the sources of the zymotic diseases, and that the various diseases are, in fact, all of glandular origin; that in every case of disease the virus producing it is nothing more and nothing less than a modified form of one or other secretion, and that as regards the organic poisons themselves and their physical properties, the great type of them all is represented by the poison

of a venomous snake. If we puncture the poison bag of the cobra, for example, there exudes a peculiar fluid substance almost like clear gum-water. That is the poison. If we gently dry that poison down, it becomes a darkish, somewhat powdery, half-glistening mass. If this substance be mixed with water and inoculated it is still poisonous, and if an animal be inoculated with the virus so as to be poisoned by it, the secretions of that animal in their turn yield a virus which produces similar symptoms.

On this explanation as to the production of a specific virus, it is inferred that the increase of virus in an affected animal does not depend upon multiplication from a germ, as offspring multiply from parents, but that a particle of any one of these poisons brought into contact either with the blood of the living animal or with certain secretions of the living animal, possesses the property of transforming that secretion into a substance like itself.

The process of change is cătalytic. It is a change by which a body is transformed by the presence of some other body which does not itself undergo change.

The multiplication of the poison takes place through the force of secretion of the person affected, not through the deposit of vegetable parasites and multiplication of them, nor from propagation of living germs. If, for example, the poison from the eye of a person suffering from contagious ophthalmia passes to the eye of another person, presently there is a free secretion, which in turn becomes affected and poisonous. It is not that the particle of poison has propagated a new particle, but it is that the natural secretion of the eyeball has come in contact with a speck of poisonous matter, and immediately at that point, where the speck of poison was implanted, there is a change in the secretion. This process widens the circle, more secretion pours out, more poison is produced, and the increase goes on until, in the end, the whole body of the animal may become affected by absorption of poisonous matter into the blood from the injured surface.

As a general rule the human body furnishes, I believe, all the poisons that the human body suffers from, that is to say, ordinary secretions may change and become poisonous without previous infection. This has been remarkably brought out in the case of puerperal poison, where a secretion from the hand of the accoucheur has produced the puerperal fever. In the case of peritonitis, or inflammation of the peritoneum, there is a secretion

which may be carried on the hand of a healthy person and produce the disease. Typhus may be produced by the overcrowding of persons in a room, through the vaporization of organic matter at a low temperature. Thus we may have springing up *de novo* an organic poison which afterwards, on being introduced into one particular body, becomes increased by the secretions of that body.

The organic virus so formed may be transmitted in each of three ways. It may travel as dry solid matter, wafted or carried in the air. It may be borne by linen that has been tainted with the secretions of patients and then dried. It may travel in water or in water suspended in the form of vapor.

The mode of the entrance of organic virus into the body, although contact is always required, varies with its different kinds. The virus of measles, scarlet fever, and typhus is, I believe, always inhaled. The virus of small-pox, diphtheria, glanders, erysipelas, and hospital fever, may act either by being inhaled or inoculated. The virus of ophthalmia requires direct contact. The virus of cholera, yellow fever, and typhoid fever seems always to be swallowed; each may be called, specifically, a poison of sewage, travelling, usually, in the fluid form; each may, nevertheless, travel for short distances as fine dust, or in water in the form of vapor.

The thought that the virus of the various spreading diseases is a secretion, and nothing more, came naturally out of my researches. I realized, as it seemed to me, that all these spreading and communicable diseases spring out of the living body itself. That they are as distinctly the offspring of living animals as real progeny are, and that to look to outside sources for them, to look to vegetative growth for them, for example, or seedling, is merely to ignore the basic facts which lie obviously before us for lesson and learning. As well suppose that procreation of animals is due to an external vegetable product or other product dissevered altogether in its origin from the animal, as that the virus which creates disease of a communicable kind is in such manner dissevered, as to its origin.

Another thought which occurred to me in the course of my labors, and which I expressed in the earliest records of them, has relation to the force by which the poisons of the various diseases are developed and thrown off. It is well known that the production of the poisons in a living body, infected by one of them, is

limited in respect to duration of time of production even when the body lives and recovers. This fact seemed to me to prove to demonstration that the poison itself is produced by the affected body, and is determined, in its production, by some natural function of the body or of some part of it.

On the basis of my hypothesis that the virus in every case is a modified secretion, this view of the force of production of the secretion is easily accepted as in accordance with natural law. The force of production is the force of secretion, and so long as the secretion continues changed in character, so long it is thrown off as a poisonous secretion; but so soon as the modification of secretion which rendered it poisonous is stopped, so soon the secretion, flowing onward as before, is rendered innocuous, that is to say, no longer poisonous. If this were not the case, there is no reason, as far as I can see, why, in every instance of infection, the infected person should not die. Endow the poison itself with independent forces of life and of reproduction, give to it a distinct reproductive life of its own, and why should it ever cease to reproduce? Why should it not, in every case, continue to increase within the infected body, indefinitely, until it kills the body, and why should any one ever recover?

But consider the poison as a part of the animal body itself, a substance to be eliminated from the body by natural methods, then the process of removal of the poisonous condition comes into the natural order of events, and recovery is a natural process, unless some unusual conditions occur to interrupt the natural course.

We see in a common nasal catarrh the outline of this process. There is first a dryness of the secreting surface, with reflex nervous irritation and much nervous depression, and disturbance thereupon, in the circulation of the blood. After a time there is a copious secretion from the nostrils, which continues until the disturbed nervous balance is brought back to steady natural action. At this time the overflow of secretion is checked, and nothing more is left than the local effects of hardened secretion, or scale, due to desquamation arising from the excessive previous action.

In outline this is really the natural course of every zymotic disease, with the exception that the secretion of a catarrh is not definitely proved to be a contagious secretion. I believe it may

be so, and sometimes is so; but I need not press the point. The illustration is adduced merely to show that the course of the disease is from within outwards, and that it is checked in its course by restoration of internal natural function. If catarrh were produced by some external vital agency, reproductive in character, lighting upon the nasal tract; if it were due to the colonization of the nasal tract by an army of foreign invaders which settled there, and began and continued to replenish and multiply, when would the catarrh cease? It would, as far as I can see, continue, until, by destruction of parts and continued abstraction of secretion and extension of mischief over a wider tract of surface, it killed inevitably.

A catarrh, according to my view, is typical of all the diseases which run a given course, and are called spreading diseases. It springs up constantly from external atmospheric variations; it runs a given course; it subsides. It is often epidemic, and it would be a true contagious epidemic if the matter secreted from the nasal cavity and the conjunctiva were not so innocuous. As I have hinted already, I believe it may be contagious. I am quite sure that many times in my life I have taken catarrh by coming near to a person who was affected by it, but whether this contagion is sympathetic or toxic, I am not able to define. On these intimate relations I shall have more to say on a future page.

In continuance of observation I have noted that the number of the distinctly communicable diseases is closely related to the number of secretions. The poison of hydrophobia is from the salivary secretion; of diphtheria from the mucous glands of the throat; of scarlet fever, I believe, from the lymphatic glandular secretion; of glanders from the mucous secretion of the nasal surface; of typhoid from the mucous glands of the intestinal surface. In some instances the blood itself is infected, and the corpuscular matter becomes the seat of the catalytic change.

On the ground that the virus is always from a secretion I have been led to the conclusion that under certain influences affecting glandular action the virus may be made to originate directly through nervous impression without the necessary intervention of an infecting particle. In many epidemics it is common to see a number of examples of the prevailing disease the origin of which is traceable only to fear or anxiety. We call these nervous cases, and we try to define them as such and as distinct from cases due

to contagion of a direct kind. But the symptoms are the same as those which follow actual contagion, and in epidemics of cholera they take even a fatal character. My view explains, fully, the reason of this. It indicates that an extreme nervous impression acts on the glandular nervous supply, paralyzes the glandular function, and thereupon produces the same phenomena as is produced, in other instances, by the action of a specific poison.

The hypothesis in this manner accounts for the origin of an epidemic disease from an impression made on the nervous system without the direct contact of poisonous matter, as well as for the after-propagation of the disease by distribution of poisonous particles when they are communicated from an infected to a healthy person. It accounts equally well for the production of disease and of a poisonous glandular product under conditions of starvation and cold, by which the nervous tone is reduced. Again, it accounts for the production of disease and of a virulent glandular secretion under special atmospherical conditions, in which the activity of the atmospheric oxygen is reduced in sustaining power.

It has occurred to me further, as a result of the study of the action of the poisonous particles, that when they are brought into contact with the secreting surface, their action towards the body at large is, in the first instance, directly on the nervous fibre. They act in the first instance as irritants on the peripheral nervous surface, and their effect may, I believe, extend particle by particle, as by diffusion, through the whole length of the nervous cord to the nervous centre. I have no doubt this is what slowly takes place in hydrophobia. I believe this is what takes place in diphtheria when paralysis is the sequel of the acute symptoms of the malady. I believe the same mode of progression of the poisonous influence is what happens after inoculation with matter of small-pox; that the severe nervous symptoms which mark the onset of that disease are due to the extensive injury inflicted on the nervous organization; and, that the diffusion of the eruption over so wide a surface of the skin and mucous membrane is the reflex on the peripheral nervous surface from the nervous centres.

It is worthy of special notice in connection with this part of my subject, that in the communicable diseases attended with an eruption on the skin or nervous surface, the eruption, as a rule,

takes a circular form. If it be a point of vascular blush, a petechial spot, it is a rounded spot; if it be a pustule it is rounded; if it be a more diffused rash it commences in centres which are rounded points. This appearance is an indication of nervous injury. The rounded surface is the radius of injury done to the nervous supply of that part. It is a paralysis of the centre of nervous distribution over the affected part.

My researches on the influence of extreme cold on nervous function are strikingly illustrative of this. They suggest that the nervous impressions sent from the centres to a peripheral surface spread out when they reach the peripheral surface, such as the surface of the skin, like circling waves; as water spreads out in circles on a pool when a stone is made to impinge on it. The time required for this change is, I conceive, the period of incubation in zymotic diseases.

Some other recent investigations on the mode of action of the poisons of the communicable diseases have led me to suspect the source of the symptom which is so common to most of them, and which is known as the attendant fever. The fever is of three kinds: primary, reactive, and remittent. The primary fever is that which precedes and attends the eruption of an eruptive disease. The reactive fever is that which succeeds the extreme collapse of an acutely-exhaustive disease, and is like that which follows exposure to extreme cold. The remittent fever is that which succeeds upon an acute form of disease, and indicates that there has been either secondary absorption of matter from an abraded surface in contact with poisonous substance, or that some fibrinous or pustular matter has formed within the body, and become a new and permanent centre of infection.

The first of these forms of fever is, I believe, due to the impression on the nervous centres by the poison, in the manner I have described above.

The second, the reactive fever, is, I believe, due to the same action as that which locally may be induced by extreme cold, viz., by an influx of blood into vessels that have been paralyzed, and by a rapid radiation of heat from extensive surface of blood.

The third form of fever, the remittent, has an origin, I believe, specifically its own. I have found that pustular matter and all secretions containing fibrinous or cellular structure have the property, by their presence, of liberating oxygen from solution. This

extends, as I have found, to blood charged with oxygen, and I am led to the inference that when there is an absorption of such matter into the circulation it causes an undue liberation of oxygen, with a quicker combustion, or fever, which lasts until the exciting matter is itself destroyed and eliminated, and which does not recur until there is re-absorption of more of the exciting agent. In this physiological mode I should explain all the phenomena of the remittent attack; the cold stage incident to the absorption of the exciting matter; the hot stage incident to the period when, by its presence, the exciting matter is setting free excess of oxygen; the sweating stage when, by rapid elimination through the sweat glands, the equilibrium of temperature is restored.

The study of the nervous hypothesis of the communicable diseases has suggested to me another thought, which observation of the diseases fully confirms, namely, that these diseases, like all which have their root in nervous derangement, present a distinct heredity. The impression of disease made on a nervous centre is transmitted. There can be no doubt as to transmission of tendency to particular communicable diseases. Any physician in full practice can find any amount of evidence on this fact by simple natural inquiry. Typhoid fever is clearly a disease possessing hereditary transmissible quality. Diphtheria is the same. Scarlet fever is the same, and small-pox I should suspect was once, almost universally, so characterized. These facts alone, one of them alone, is sufficient to stamp the origin of the communicable diseases as from the animal body itself. It is certainly one of the best of proofs of the truth of the hypothesis of the nervous origin of the poisons.

It will be seen by those who look with sufficient patience, that the mode of connection of the diseases in hereditary line is the same as that which connects hereditary types of every kind, physical type, mental type, all else that binds many individualities into one family.

Lastly, the study of this hypothesis of the communicable diseases enables me to offer the most rational explanation of the phenomenon of non-recurrence of the diseases after they have once attacked a person susceptible to them. It is well understood that, as a rule, a person who has been affected by a communicable disease is not affected a second time. To this rule there are many exceptions, but on the whole it holds good. On

my hypothesis the reason of the phenomenon is simple enough. They who are susceptible are born with a nervous impression tending to the production of a diseased secretion easily changed into a poisonous secretion under the direct action of contact with poisonous matter, or even under the influence of a central nervous depression whereby the glandular function is deranged. But when such a person has passed through the ordeal, the tendency, for a time at least, disappears, owing to the complete modification of glandular function that has been induced, to the free elimination that has been established, and, probably, to the change in the nervous matter itself that has resulted from organic modification. Hence the organism becomes insusceptible for a time, and if the tendency be not intense that time may mean the whole of the life. Indeed as life advances and nervous susceptibilities, derived directly from ancestry, lapse into individual self-sustained susceptibilities, these tendencies to disease subside as a general fact, and lose their activity if not their existence.

It is not therefore a new pabulum that is formed to insure a repetition of infection, but the removal of the capacity to produce a new virus which will act on existing ordinary pabulum.

Lastly, this hypothesis connects together in natural order the relationships of the physical to the moral contagious diseases, the border land between which is often all but undefinable.

In both instances of communication of contagion, the first impression of the contagion is on a peripheral nervous point or surface. For the moral contagious phenomena, the peripheral expanse of an organ of sense is the receiving point. For the physical contagious phenomena, a point in the peripheral nervous expanse of skin, of mucous membrane, or of serous membrane, is the receiving point. The diseases which spring from contagion are all, therefore, primarily, nervous in their mode of development in the bodies of the affected.

The physical contagions are either absorbed through nervous matter, or they excite, by contact, a change which extends along the nervous matter, the period of incubation being the period during which the contagion is extending its influence to the nervous centres, so as to excite central disturbance. In some instances the first effect of such contagion is indicated in a few hours, as in cholera; in other instances the effect is delayed for many weeks, as in the case of hydrophobia.

The active organs of the body first and specifically affected by the physical contagions are the glands. When the contagion is moral, and extends from irregularity of muscular motion to functional change of organs, the action, caused by the nervous disturbance, is also on the glands. It is a nervous reflex of some glandular affection that has been observed by the sufferer. It is like the weeping which some persons exhibit at the sight of weeping, though they themselves may be unaffected by the primary cause of sorrow.

Moral contagion is the mere continuance of motion from one person to another; a direct impression made through the senses into the internal nervous centres. It is like the motion which can be excited in a compass needle by bringing a magnet within the sphere of communicable action. It acts at sensible distances. Physical contagion is the movement of a point of affected matter into contact with a surface of the body through which the nervous organism can be reached. It acts at insensible distances.

The diseases arising from moral and physical contagions are so closely related, that one may lapse directly into the other. Both assume sporadic and epidemic forms. Practically, they are of the same origin, and are convertible phenomena.

Summary of the Hypotheses.

The reader has now before him the three hypotheses of the origin and cause of the so-called zymotic diseases.

The first assumes for the cause a vegetable parasite which exists outside the body and which carried into it sets up a fermentation, if there be pabulum in the body to undergo the process of fermentation, and is itself reproduced so long as there is any pabulum for its sustainment.

The second assumes that the cause is a living germ, which belongs to the body itself, but which has undergone change of deterioration, in which condition it reproduces, from a favoring pabulum, its like in large quantity, and thus excites disease.

The third assumes that the virus which excites the disease is a modified secretion which has the power of communicating, by an interference with nervous function, its own properties to a healthy secretion, and which continues in action until natural nervous function is restored.

By all these hypotheses the same results are reached in one particular. They all assume that the affected or diseased body produces or reproduces something which is organic and material, and which passing over from the diseased to the healthy but susceptible person, is capable of exciting the same disease in the susceptible. To which view the nervous hypothesis adds that the phenomena of the disease may also be excited *de novo*, that is to say, without the contact of infection, by the following modes.—(*a*) Change of a secretion from simple nervous disturbance.—(*b*) Change of secretion excited by atmospheric conditions—so-called epidemic influence.—(*c*) Change excited by irregular and imperfect sustainment of the body. This hypothesis also connects the ordinary or physical with the moral contagious affections.

In favor of the first or parasitic hypothesis there is the matter of analogy. It cannot be denied that the illustration with which I prefaced that hypothesis, in which the fermentation of saccharine solution by yeast was compared with the action of small-pox virus on a susceptible living body, is striking, as an illustration. There is, admittedly, an analogy. Here, however, analogy, always a doubtful argument unless it be supported in every detail, is altogether unreliable. Even in regard to small-pox it does not hold its ground, because in the virus of small-pox a vegetative growth similar to that which is detected in yeast is not detectable, and cannot be, what is called, cultured; so that at the very outset the analogy breaks down.

When we extend the analogy from one disease to the diseases of the whole of the zymotic group, the failure is even more conspicuous. If it were true, a particular parasitic growth should be detectable in every disease, which is not the fact. If it were true, specific forms of fermentation yielding specific products of fermentation, should be met with in every case, which is not the fact. If it were true that living germs possessing an independent growth and vitality enter the animal body, that every disease of a communicable kind is due to its own external living germ, and that the germs continue to multiply and increase by an independent action of their own; if this were indeed true, why do the germs after a certain time cease to multiply and allow the sick person to recover? Why do they not go on multiplying until the person is infested in every part and fatally stricken? Who would get well from a disease due to living self-propagating con-

tagions? Again, who, if the hypothesis were true, would escape fertilization? A general fertilizing diffusion of self-propagating matter, in minute invisible form, entering the body as the air may enter, could hardly be expected to select a small minority of a population, and if it did so at the first, why should it do so when it had seized upon many centres in which it could increase? But the history of all the communicable diseases shows that each epidemic affects individuals individually at different periods in the course of the epidemic, according, as a rule, to exposure to the infected, and that the period of the disease is limited by a development and a course rendered in certain periods of time.

If, again, the parasitic hypothesis were true, the question of heredity in respect to tendency to particular diseases could have no place. A germ of disease extraneous altogether to the body until it came accidentally into contact with it, can have no connection with heredity as a first cause of disease. As a secondary cause such a germ may truly find a part; I mean, that when a disease is once excited, a floating vegetable germ in the atmosphere may find, in the diseased body, a home in which it can multiply, pabulum on which it can live, and a function which may rather be useful than otherwise to the affected, by playing, as Professor Owen has put it, a scavenger's part. But this is not the production of disease; it is merely an illustration of one of George Herbert's happiest proverbs, singularly applicable here, "*Flies are busiest about lean horses.*"

Of Dr. Beale's hypothesis, the living germ hypothesis, I would speak with the greatest possible respect, and in regard to its application in one direction, the production of pus, or purulent matter, in the living body, it is the most rational, as it seems to me, of all the views that have ever been propounded. At the same time I cannot apply it to the whole series of spreading and communicable diseases, with their varying periods of incubation, their varying phenomena, their varying modes of termination. I think it sometimes forms a part of the history of every one of these diseases, modifying them in their course, or determining their end. But I cannot see it as primary.

On the whole I abide by the last hypothesis, or that which attributes the so-called zymotic diseases to a change in the natural zymosis, induced by an impression made upon the nervous system. I believe that this view explains fully why the first symp-

toms of all the diseases point to nervous derangement; why there are varying periods of incubation ; why there are hereditary tendencies for and against the particular diseases; why a certain measure of protection is afforded by an attack of one of these diseases; why a purely mental or nervous act excites these affections; and why there is so close a correspondence, running even with season, between physical and moral outbreaks of spreading and contagious affections.

Lastly, I maintain the hypothesis of nervous origin because of the practical usefulness of it in relation to prevention of disease. If the view were true, that the air around us is charged with invisible germs which come from whence we know not, which have unlimited power to fertilize, which need never cease to fertilize and multiply, what hope is there for the skill of man to overcome these hiddden foes? Why on some occasion may not a plague spread over the whole world, and destroy life universally?

The nervous hypothesis presents an altogether different aspect. It says to living men and women, it is you who are the producers of the communicable diseases, or if it be not you yourselves it is one of your lower earthmates in creation, some domestic animal that shares with you the power of producing a poisonous secretion and of giving an hereditary stamp of production to such poisonous product. It looks on the man or animal affected with a contagious disease as one precisely, for the time, in the position of the cobra or other animal that is naturally secreting a poison; and, recognizing this fact, it suggests at once that the danger is all but limited to the person affected.

Isolate that person from the rest of mankind, take care that his secretions, volatile, fluid, or solid, do not come in contact with the secretions of susceptible healthy persons, and the danger is over. With the recovery of that person, that is to say, with restoration in him of a natural secretive process, the poison is destroyed; or should he, unfortunately, die, then with the failure of his power to produce further secretion the danger is over, except some of the poison formed before the death be actually carried away from the dead body. In a word, if the hypothesis be true, we sanitarians have complete mastery over the diffusion of the poisons of all the communicable diseases. We have but to keep steadily in view that the producing and reproducing power

is in the affected body itself, and we can then limit the action to the propagating power of that body,—its power, I mean, of secreting and diffusing secretion,—even with our present knowledge, all but completely.

Beyond this, if the hypothesis be true, we must expect, as we reduce the communicable diseases of one generation to reduce the tendency to them in the next generation, so that in time the heredity to particular spreading disease shall be thoroughly wiped out.

CHAPTER IX.

INDUSTRIAL AND ACCIDENTAL CAUSES AND ORIGINS OF DISEASE.

In the last chapter I brought to a close the study of the principal causes of the *natural* diseases affecting mankind. The causes of the diseases which are induced by our own acts and deeds were exposed as the diseases were, one by one, described in the chapters of the Second Book on Acquired Diseases. I need, therefore, do little more in this present chapter than condense the chief of these acquired causes, as they affect the industrial populations, into the following classified forms.

Industrial Causes.	Parts Affected.	Diseases Induced.
Cigar-making Lace frame-making Pottery Painting and lead-working Fur-dyeing Bronze-founding Paper-staining Tinning and brazing Needlework Tailoring Clerk's work Draper's work Vine-dressing	Digestive System.	Dyspepsia. Gastro-enteric irritation. Nausea and vomiting. Pyrosis (water brash). Muguet. Choleraic Diarrhœa. Colic. Constipation.
Pottery working Painting and lead working Aniline dye-making Chemical manufacturing Working in bisulphide of carbon Working in bisulphide of mercury Brazing Fur-packing Engine-driving Railway service Coffer-dam working Cigar-making	The Brain and Nervous System.	Vertigo. Cerebral exhaustion and paralysis. Cerebral congestion. Apoplectic coma. Neuralgia. Mercurial Rheumatism and Neuralgia. Dementia.

Industrial Causes.	Parts Affected.	Diseases Induced.
Cigar-making Lace frame-making Bleaching Hat-making Fur-dyeing Aniline dye-making Needlework Tailoring Draper's work Dock laborer's work Drayman's work Potter's work Postman's work Groom's work Bone-boiling Blacksmith's work Farrier's work Boatman's work Laundry work Clerk's work Coal-heaving Butchering Waiting Porter's work	Blood and Circulatory System.	Palpitation and irregular action of the heart. Intermittent action of the heart. Enlargement of the heart. Valvular disease. Degeneration of the structure of the heart. Aneurism. Cyanosis. Extreme fluidity of the blood. Anæmia.
Pottery working Millstone and stone-cutting Pearl-cutting Sandpaper-making Needle and knife-grinding Hemp and flax-dressing and spinning Rag-working Milling and flour-working Wood and ivory turning and carving Cigar and tobacco manufacture Walking-stick-making Hair-dressing Brush-making Fellowship porter's work Burnishing Paper-staining and artificial flower-making Mining Trimming-making Alkali-making Tailoring Draper's work Clerk's work Paving	The Respiratory System.	Phthisis pulmonalis or pulmonary consumption. Bronchitis, acute and chronic. Bronchial phthisis. Bronchial irritation. Emphysema. Asthma. Spasmodic and Flax Asthma. Chest spasm.

Industrial Causes.	Parts Affected.	Diseases Induced.
Dock laborer's work Carpentering and cabinet-making Waiting Butchering Needlework	The Respiratory System (Continued).	Phthisis. Asthma. Emphysema. Bronchial irritation. Bronchial phthisis. Bronchitis, acute and chronic.
Vine-dressing Working in bisulphide of carbon Working in Cyanide of potassium	The Sensory System.	Ophthalmia. Double vision. Impairment of vision. Amaurosis. Deafness.
Working in mercury Working in lead	The Glandular System.	Irritation of salivary glands and salivation. Nephrosis. Chronic inflammation of Kidney. Paralysis.
Pottery making Painting and lead working Fur-packing Cigar-making Working in mercury Working in bisulphide of carbon Bronze founding	The Muscular System.	Mercurial tremor. Cramp. Spasm. Atrophy. Inflammation of bone.
Pearl working Fur-dyeing Working in mercury Working in phosphorus Domestic service Coal-heaving Porter's work	The Osseous System.	Necrosis. Deformities of limbs. White swelling. Caries of the teeth.
Aniline dye-making Working in mercury Working in bichromate of potassa Working in arsenic Working in crude paraffine Working in soot	Skin and Membranous System.	Aniline discoloration. Ulceration and exfoliation. Follicular inflammation. Soot ulcer.

Relationships of Occupation to Disease.

In studying the relationships of occupation to disease, I may observe that many occupations attended with disease and with a high mortality should not necessarily be considered as unhealthy from the mere influence of the industry itself. The businesses of the printer, the draper, the needle-woman, the tailor, the clerk, are illustrations of industries which in themselves are harmless, but which are connected with a very indifferent vitality. The butcher has not more hours of work than the carpenter, blacksmith, shoemaker, or baker, yet his vitality is below theirs.

The business of dock laborers would not seem to be more injurious than that of sawyers, yet they are much less healthy and have a higher death-rate.

These differences are not traceable to the occupation itself in any of the instances named, but to the conditions under which the work is carried on. These conditions are, in the main, exposure to impure air, to alternations of temperature, often great and sudden, and to exposure to damp.

The needle-woman and the tailor are perhaps the fairest representatives of those who suffer from close and impure air. Packed together in small rooms, imperfectly heated, or over-heated, and imperfectly ventilated, frequently, in fact, not ventilated at all except through the crannies of window and door and the occasional open door, these people soon become subjected to the poisonous influence of their own exhalations. Being at the same time overworked, badly fed, and unbefriended by any glimpse of change of scene and life, they rapidly fall victims to the most fatal of diseases, the disease consumption being the most common of all. They live from day to day in that form of devitalized atmosphere which I have described in a preceding page. By day this is the atmosphere of their workrooms, by night it is the atmosphere of their small miserable bedrooms, and between the bedroom and workroom where is the life?

If the class of workers named and others kindred to them do not suffer from consumption, if, in early life, they struggle past that peril, they still know nothing of health in the happy sense of the word. The women are depressed in mind and body, anæmic, bloodless, emaciated, always dyspeptic, and incapable of meeting the maternal duties in such a manner as to be just to

themselves or to their offspring. The men are pale, emaciated, restless, and unhappy, so that even the songs they try to sing, and the conversation they endeavor to carry on in order to relieve the mental gloom, soon become mere automatic monotonies, lighted up with fitful outbursts of petulance or passion, or deepened darkly by seizures of silence and intense melancholy.

The plain truth is that the workers are placed under what may not improperly be called experimental conditions for the development of disease. In them the disease of nervous feebleness is very easily lighted up if they become subjected to any change that leads to congestion of the lungs. They are exceedingly susceptible to atmospheric variations. They are tenderly susceptible to cold. They keep their rooms close in order to keep them warm, and the slightest exposure to quick and severe cold subjects such susceptible beings to a fatal shock which, though it be not immediately fatal, is the beginning of fatality. The sufferers "take cold," the cold is renewed in vicissitude of season, especially of the spring season, and with the frequent repetition cough becomes established and disease usually of the consumptive type is developed.

In an institution for diseases of the chest, to which for many years I acted as physician, this mode of development of consumption was told me over and over again, a stereotyped story. Constantly victims of the disease were not even aware that it had commenced, although it had already passed into a stage beyond the art of the physician for the hope of cure.

Clerks and printers are to some extent subjected to the same dangers from impure air as the classes above-named, and both printers and clerks are too often subject to overwork. Printers also are apt to be affected by late hours at work, and especially by working in gaslight.

In a less degree than the above-named workers drapers may be enumerated as sufferers from confinement for long hours in close and impure air. The goods with which the draper's shop is filled are specially disposed to catch and retain dust, and also to retain every organic emanation that is capable of taking a hold on textile fabrics. The draper suffers greatly from chest affection as a result of living under these conditions. In my work on "Health and Life," I have pointed out these facts in reference to drapers, and for the sake of a striking illustration have instituted

a comparison between the draper and the grocer as indicating how much more favorably the grocer is placed in respect to the value of his life. I have shown that 108 drapers die to 76 grocers, and have pointed out how the difference depends upon the comparatively out-door life of the grocer, though he too is a shopman, in contrast with the effects of the pent-up life of the draper.

Exposure to great heat is a source of risk incident to some industrial callings, such as those of the stoker, glass-blower, and laundress. If, however, there be a free ventilation in the workplace and such lightness of clothing as permits free perspiration the danger is not great. Laundresses suffer most from the great heat, for in their case the heated air is often laden with moisture, and the stoves in which the irons are heated produce a very deleterious atmosphere.

Exposure to damp is another cause of serious derangement of health and impaired vitality amongst some members of the industrial class. Harbor and dock laborers are marked illustrations of this type. They, exposed not only to severe labor but constantly to wet and inclement weather, generally die very rapidly, their mortality being 121 compared with a mean standard of 100. During exhaustion they become exceedingly susceptible to colds and affections of the chest which are destructive in character. They do not suffer so much, however, from consumption proper as from bronchitis, and from a wasting bronchial affection which, at one time, was often confounded with true consumption, but which is very distinct from true consumption, and to which, in modern times, the name of *bronchial phthisis* has been applied.

It is well worthy of remark in this place, because the facts that have been before us in the last chapter render the illustration very complete, that affections of the chest brought on by exposures to unfavorable external conditions vary, with much regularity, according to the circumstances of exposure. When the exposure is to confined air within-doors the chest disease induced or favored is, as a rule, tubercular consumption. When the exposure is to inclemency and vicissitudes out of doors the tendency is towards bronchial affection, which, though less specifically fatal to the young, is commonly fatal at a comparatively early period of the middle stage of life. The dock-laborers, and others who like them are subjected to the influence of damp, wet, and sudden variations of temperature, are, moreover, commonly

the victims of another form of disease, viz., rheumatism and the attendant physical evils which are developed upon it, heart disease and dropsy. Many of these suffer from acute rheumatic fever, which rarely leaves a perfectly sound heart.

Others, without the acute attack, undergo recurrent minor attacks which, in time, leave them more or less crippled in limb and generally disabled in the heart. The deranged action of the heart increases the difficulty of breathing and sets up symptoms usually called asthmatic, with much aggravation at every bronchial attack. Sometimes dropsy, from the embarrassed state of the circulation, proves a fatal sequel to the embarrassment.

Butchers, like dock-laborers, are much exposed to the influence of wet, damp, the variations of temperature, and other similar inconveniences. The slaughter-houses in which they carry on their occupation are cold, draughty, damp. The floor is usually of brick, and during the operations of the trade is persistently sluiced with water. The business of slaughtering is most depressing to mind and body. I have seen the strongest built men in the prime of life most painfully affected by it, and I have never met with one who could be said to have become perfectly inured to it. They all get rapidly weary of their work, and the work, independently of the slaughtering process, is fatiguing to an extreme degree. Every step in dressing an animal is carried out with great rapidity, so that the operator is made very hot from the work, while at the same time he is using water freely, and is in constant contact with the moist tissues of the dead animal. A man placed under these favorable conditions for the development of cold and rheumatism can scarcely escape, and in point of fact very few do escape. I am not far wrong in saying that no butcher can be found, in our large towns, who, after eight or ten years' daily work at the slaughter-house, is free from the effects of bronchitis, rheumatism, or heart disease, heart disease being the most prevailing malady of the class. The mortality of the butcher is, as a necessity, far above the average ; 111 butchers die to a mean of 100 of those who follow 69 other occupations.

CHAPTER X.

SOCIAL AND PSYCHICAL ORIGINS AND CAUSES OF DISEASE.

We have traced out in detail in the history of the acquired diseases, most of the causes which are at work to produce those diseases. It remains for me now to summarize a few, and these the most prominent, of origins and causes of a social or moral character. Such causes sometimes act independently. At other times they act in combination with sets of causes differing from themselves. They thus become directly active, indirectly active, or connectively active.

Alcoholic Intemperance as a Cause.

Amongst the social causes of disease I place alcoholic intemperance first, because it not only directly affects but indirectly leads to some additional evil, to pauperism, to worry, to crime, to violence, and to the lust which gives rise to specific disease.

I made a formal estimate, when I was preparing the Cantor lectures on alcohol, of the mortality caused by alcohol in England and Wales, basing the calculations on the mortality returns of the Registrar-General. The result could not possibly be so accurate as was desirable, because the returns rarely state that alcohol is an actual cause of death. They give the diseases which we know are often incident to the use of alcohol, and from the facts so rendered we infer what should fairly be attributed to it. On this method, after making what seemed to me to be the fairest deductions, I was forced to the conclusion that alcohol led, in this country, to about one-fourteenth of the whole adult mortality.

Recently the Harveian Society of London, a distinguished medical body, has made a most valuable effort, through a special committee, to arrive at the number of deaths produced by alcohol

in the metropolis. The committee collected from medical men in practice in London the certificates of ten thousand cases of death amongst adults. The facts connected with these deaths were very carefully analyzed.

The 10,000 cases, as returned, were broadly divided into three classes:—"(A), Deaths in no wise due to alcohol. (B), Deaths accelerated, or partly caused, by its abuse. (C), Deaths wholly due to it. And their respective numbers were: A, 8,598; B, 1,005; and C, 397, which gives 1,402 deaths, as nearly as possible 14 per cent., in the causation of which alcohol appears to have played some part. If this part were, in all cases, a leading one, it would correspond to an annual adult mortality of about 5,870 from alcohol in London, or 38,971 for England and Wales, assuming for the moment that the metropolitan figures would apply to the whole country."

The returns, however, required to be weighed as well as counted, and the committee consequently took every circumstance connected with them into due deliberation. Of the deaths in the lists B and C, the latter (C) were, with a few partial exceptions, entirely composed of genuine instances of death not only supervening on, but caused by, alcoholic excess, and may be thoroughly relied upon. The former (B) was a heterogeneous group of deaths, in the causation of which the share attributable to alcohol ranged from the almost exclusive to the scarcely appreciable, the fact remaining that they were all deaths of persons known, or reasonably suspected, to be addicted to drink, in which the practitioner in attendance, or the coroner who investigated the death, or the registrar or pathologist of the hospital where it occurred, considered whether, on sufficient or insufficient grounds, that death was accelerated by, or was partially due to, alcohol.

On the whole, the returns seemed to show that, in London, a percentage of adult deaths, which may be variously estimated at from little more than 1.5 to 4, is directly due to alcohol; while a further proportion of 10 per cent. of those who die have injured their health in a greater or less degree by alcoholic excess.

These in brief were the general conclusions arrived at by the members of the committee. In a further part of their labors, however, they studied the particular diseases which make up the mortality caused by alcohol. They summarize as follows:—

"We find, therefore, upon the whole, reason to think that, in

the metropolis, the mortality among any considerable group of intemperate persons will differ from that generally prevailing among adults in the following important particulars, viz., a fourfold increase in the deaths from diseases of the liver and chylopoietic viscera; a twofold increase in the deaths from disease of the kidney, a decrease of half as much again in those from heart disease, a marked increase in those from pneumonia and pleurisy, a considerable increase and an earlier occurrence of those from disease of the central nervous system; a marked decrease in those from bronchitis, asthma, emphysema, and congestion of lungs, a decrease nearly as great in those from phthisis, and a later occurrence, or at least termination, of the disease; a very large decrease in those from old age, with an increase in those referred to atrophy, debility, etc., and the addition of a considerable group referred in general terms to alcoholism or chronic alcoholism, or resulting from accidents."

I need add little to these conclusions, in so far as mortality from one cause of disease is concerned. That they do not represent many lesser evils done by alcohol, in the production of diseases of body and mind, evils which are not fatal, our previous chapters in Book II. will sufficiently testify. But they give a fair abstract of important series of facts. It will be seen by referring to the Report that the organs of the digestive system suffer most severely from alcohol; that the organs of the circulatory and respiratory systems *seem*, comparatively, to suffer less; that the brain and nervous system suffer very severely; and that the glandular organs, the liver and kidney especially, are subject to extreme danger from alcohol.

These inferences are, I believe, strictly correct with the exception of those which refer to the effects of alcohol on the circulatory and respiratory organs of the body. I am convinced, both from experience of symptoms, and from pathological inquiry, that these organs suffer from alcohol as severely as the others.

Dietary and Cookery as Causes.

Bad dietary and bad cooking are active causes of disease in, perhaps, all classes of the community, but especially amongst the poorer. In the industrial classes the greatest differences prevail in this respect. Amongst the stocking-weavers of the Midland counties we see, as a rule, the most striking evidence of defi-

ciency of food ; and the same extends, though perhaps in a minor degree, to the majority of the industrial callings. Together with deficiency there is combined the most serious errors as to quality of food, the tendency, for the sake of economy, being towards a too exclusive starch dietary, and to the omission, in great part, of nitrogenous food. Thus the muscles and other nitrogenous structures are imperfectly developed, a thin emaciated state of body is maintained, and a parched and feverish state of the system is engendered. Naturally these conditions lead to dyspepsia, and from the dyspepsia, in those who are disposed to the disease, the phthisical tubercular malady readily commences.

Lastly, on this point, in cases were the food is fairly good in quality as it first comes to hand, it is so destroyed by the various processes of cooking and preparation that half its proportions as digestible, wholesome, and sustaining nourishment, are sacrificed.

It is not until these facts are actually witnessed, it is not until the cold, uncomfortable, indifferently prepared artisan meal is seen, that the mischiefs arising from it can be appreciated. The mischiefs extend through all ranks of the industrials with more or less of intensity, and through all periods of life from childhood to old age. We can scarcely wonder that alcohol should be so frequently substituted as a false replacement of a dietary that is so generally objectionable.

While these errors in dietary are the rule amongst the industrial classes, some exceptional errors of an opposite kind are met with in certain localities. Thus, to take one example which I have noted. Amongst some colliery operatives I have not only known provisions abundant but luxuries holding a prominent place. In the early part of the week, when they have their wages in hand, these industrials "play," as they call it, and live in sumptuous style. They select the choicest viands that can be obtained, and will have whatever is in season. Ducks, geese, lamb, game, asparagus, everything that money can buy they purchase, so long as there is money in the locker. Not unfrequently they keep up this feast for three or four days in the week, and then they fall to work again and live on anything they can get, faring as badly as they before fared sumptuously, the ordinary staple of animal sustenance being pork.

The diet of a population leads, almost, to the introduction of racial peculiarites, and no estimate of vitality resulting from

labor is of strict value until the diet is known; for, in truth, labor is the conversion of the force contained in food into motion and work; but with the millions, the natural intention of food is hardly understood; they eat as animals eat, from the impulse of instinct.

In the infant population bad feeding is a cause of intestinal mischief. More than half the diseases of the digestive system which occur in infancy are due to improper food and feeding.

Amongst the adult rich the errors of over and luxurious feeding are common causes of organic deterioration.

The digestive system is first injuriously influenced by errors in dietary, but many other of the vital systems, including, specially, the circulatory, the nervous, the glandular, the muscular, and the membranous, are injured by these errors in respect to supply of food for the sustenance of the body.

Moral Surroundings as Causes.

Amongst the industrial classes there is another set of causes at work which lead both to mental and physical derangement of health. I refer to the moral influences affecting the industrial classes. The necessity of having to work in masses in the same building, and at the same monotonous, ever-repeating labor, in which the muscles are moving with automatic regularity, and the brain is left unemployed except to brood over real or imaginary injuries, affects life to the core, and exerts a lasting and injurious effect on the vital value of the manufacturing classes.

The agricultural laborer may work hard, fare badly, be housed shamefully, but he has advantages. He is engaged out of doors in the fresh air; he has all the beauties of the external nature to delight and refresh him. His work is varied. There is the spring-tide season, with its sheep-washing and shearing; the summer with its hay-time; the autumn with its harvest; the other months of ploughing and sowing;—a constant roundelay of work, with varied change for the mind as well as the body.

The artisan has no such reliefs. He passes day by day, month by month, year by year, through the same monotonous labor, until at last his mind recognizes but one scene; his hands fall but to one automatic routine. To the end of his career he sees no change, nor chance of being made independent by his skill and his industry. He, therefore, is naturally apt to become

fretful, anxious, irritable, the victim of smouldering passions, which wear out his heart, and lessen his nervous resistance to the many external shocks to which he is daily subjected. Moreover, the limitation of his means leads to limitation in the necessary comforts of his home. He who is in these straits is rather to be pitied than blamed, if in false measure of the deed he seeks ignorantly still more sorrow in alcoholic indulgence.

When we add these difficulties up, the struggle against penury and actual want, the confined dwelling-room, the badly-ventilated, over-stocked bedroom, the indifferent couch, the limited sleep, the ever-returning toil, and the rarity of wholesome relaxation, either of mind or body; when, I say, we add up these difficulties, we have before us evidence of vital strain which practically is resisted longer than, at first sight, we could imagine to be compatible with human endurance. The late Dr. George M. Beard, of New York, in an admirable essay bearing on this subject, thus felicitously condenses the conditions I have glanced at.

"Almost all muscle-workers," he says most truthfully, "are born to live and die poor. To live on the slippery path that lies between extreme poverty on one side and the gulf of starvation on the other; to take constant thought of to-morrow, without any good result of such thought; to feel each anxious hour that the dreary tread-mill by which we secure the means of sustenance for a hungry household, may, without warning, be closed by any number of forces over which one has no control; to double and triple all the horrors of want and pain by anticipation and rumination,—such is the life of the muscle-working classes of modern civilized society; and when we add to this the cankering annoyance to the workman that arises from the envying of the fortunate brain-worker who lives in ease before his eyes, we marvel not that he dies young, but rather that he lives at all."

The nervous system is the chief suffering system from bad moral surroundings.

Uncleanliness as a Cause.

Uncleanliness is one of the commonest causes of disease. It extends in its bad action from the acquired diseases to those diseases which are called natural. Uncleanliness in respect to food favors many of the diseases which are manifested in the diges-

tive system, and especially of those affections which are of a parasitic nature. Animal and vegetable food which is charged with parasitic life is unclean food, and, as we have seen, is a cause of some of the most troublesome as well as of some of the most dangerous affections. Water containing organic or inorganic impurities is uncleanly, and is a cause of many diseases affecting the alimentary system. Thus water as the bearer of organic virus is, indirectly, the uncleanly cause of the disease called typhoid fever, and, as the bearer of the inorganic poison, called lead, it is the indirect cause of lead colic. Some affections of the nervous system are induced by uncleanliness in feeding. Thus those who work in lead, and do not take care to cleanse their hands, are, as we have seen, subjected to paralysis from absorption of lead. The same fact applies to uncleanliness in regard to other agents which are absorbed by the skin in uncleanly occupations and which affect the nervous centres.

Air rendered uncleanly is a cause of numerous diseases affecting the blood and the circulatory and respiratory systems. We have seen this fact illustrated in a variety of ways in the preceding pages. All the diseases produced by impure vapors and by dusts are due to this form of uncleanliness, as well as the affections attributable to a deteriorated or devitalized atmosphere.

The cutaneous or external membranous surface of the body is of all parts most subject to suffer from uncleanliness of person. Many of the parasitic diseases, scabies particularly, are determined by uncleanly habits though they be not directly generated. Sores upon the skin and abrasions in folds of the skin are the common results of accumulation of dust and dirt on the surface. We have seen how in disease from paraffin and soot (pp. 370–72) the skin suffers in this manner. Uncleanliness of the skin leads also to general ill health of body. When the skin acts imperfectly from being oppressed with a covering which closes up the perspiratory ducts and prevents free evaporation of water from the body, there is an excess of transpiratory function, vicarious function, thrown upon the lungs. When there is excess of work, vicarious work, thrown upon the lungs, the liver soon begins to suffer, and the digestion becomes, thereupon, deranged. With this there is accumulation of gas or flatus in the stomach and intestines and greatly impaired digestive activity. Hence persons

who are not given to ablution of the body are always troubled with flatulency and indifferent digestion.

In addition to the above-named causes, I might add those which have passed before us as worry, unnatural physical exertion, and moral contagion, all causes which tell, primarily, upon the nervous systems, and afterwards upon those organs which depend upon the nervous centres for their vital power.

CHAPTER XI.

SENILE DEGENERATIVE CAUSES OF DISEASE.

To all these various classes of disease, divided, so far, in respect to origin, into six groups, must be added those changes which are specially incident to old age, and which are said to indicate the progress of senile decrepitude and decay.

Each period of life is marked out as belonging to one or other of four distinct stages of progress. There is a first period extending from infancy to complete adolescence, through a range say of thirty years. There is a second period extending from thirty to forty-five years, which embraces a time that reaches from completed adolescence up to completed manhood. There is a third period extending from forty-five years to about sixty-five, which includes a time when the body has attained what may be called full lifehood, and retains it without much shade of change if the conditions necessary for natural life are fairly observed. Lastly, there is a period prolonged from sixty-five to ninety or even a hundred years, in which the body is passing from completed lifehood into natural decline.

The first two of these stages seem to be fixed and ordained by strict rules amongst members of the human family. The two last-named periods are not so fixed, but either of them may be reduced or extended. Some men and women have passed into their declining stage so soon as they have reached perfected lifehood, and die without showing any third or retaining stage at all. Others retain fair perfection of lifehood even up to the seventieth year, and decline so slowly that their fourth stage may be extended many years beyond the ordinary duration: these seem, positively, to live a new life, to experience a rejuvenescence under which they may attain to even a hundred years.

Through all these stages there is a certain line of true physical change. In the first stage all the organs and parts undergo

the enlargement and development which constitutes what is called growth. In this stage the elastic tissue of the elastic mobile organs is brought up to its full range of tension, to as much as it can bear with equality of resistance and with evenness of action. In the second stage the elasticity is maintained, but is not imposed upon by further force of growth, while all the organs, brought now to their fulness of development, are consolidated and fashioned into working order. In the third stage the perfected organism, though no longer naturally expanding or growing, and no longer possessed of its previous elasticity, is enabled, nevertheless, to endure a certain long and defined phase of work and movement. It does not truly repair so readily as it did; does not bear shocks, mechanical or mental, so well as it did; but still it works on, a good steady, hardy organism, and in some powers of a mental kind is better endowed than at any previous period of its existence. In the last stage the physical decadence of the organism is the notable fact. In this stage the once elastic fabric has ceased to be elastic, and affords little resistance or resiliency. The once elastic arterial tubes which recoiled after each stroke of the heart, and by counter-stroke helped on the circulation of the blood, gradually fail. The resilient lungs which, by their elastic fibres, responded to the impulse of the respiratory muscles, gradually fail, so that the emptying of the lungs of their contained air is imperfect, and breathing is shortened. Then within the tissues of the relaxed organs new products ceasing, under an impaired nutrition, to be formed, the organs shrink. Then the blood, circulating more languidly, and diminished, is reduced in volume and in vital warmth. Then the brain and nervous structures undergo the physical change called sclerosis. Then, at last, all organs and parts passing gently into inertia, the extinction of life from the periphery or circumference of the body towards its centres, leads to complete arrest of motion, or, as it is said, death.

It is in this last stage that the phenomena of the natural disease by which life is terminated is developed. The disease is sometimes located in one organ, sometimes in another, and by the organ most affected the mode of death is commonly recorded. Really, however, when at the full period of life one vital organ fails, so dependent are all the vital organs on each other, they all soon begin to fail with their fellow, and follow it into its deathly decrepitude. From observation founded on this fact came the

wise saying of one of the shrewdest of philosophers, that old men are "like ruined towers." They hold up, wonderfully, so long as they hold up together and as one; but touched at a single part they fall in mass.

Because their vital activity is less than it was in earlier times of life, old persons are less liable to be affected by some of the acute diseases that are incident to the early days of vital power. Thus they are saved from various causes of danger. For the same reason, however, they are more exposed to danger when they are attacked with maladies of an acute character, and sink easily from even slight attacks of acute disease.

The period of the year in which the aged most frequently succumb extends from the close of November to the end of April. The period of highest mortality or absolute maximum is January. These are the periods marked by cold and dryness and cold.

The period when the mortality from old age or senile decay is the least extends from May to November; the time of lowest mortality or absolute minimum being from July to October.

So soon as the month of November is on the advance mortality from senile decay begins rapidly to rise, an indication that the wave of cold, now setting in, is telling upon the reduced vital powers.

The organs of the body which are most frequently points of failure are the lungs, a fact which has led some authorities to conceive that in every case of natural decline the primary failure is from the respiratory surface. A dogmatic statement to such effect is, I think, too absolute. But it must be conceded that as no surface of the body is so directly affected by cold air as the breathing surface of the lungs, this is the surface which in a large majority of cases is primarily affected. Hence the number of aged people who, during the season of cold, and of cold and damp, sink from bronchitis, acute or chronic, pulmonary congestion, asthma, spasmodic breathing, and other affections of the chest.

It often happens owing to this weakness of respiration that aged people going from a warm room, in winter time, to sleep in a bedroom where a fire is not retained during the whole of the night, are subjected to acute congestion of the lungs as the result of the rapid fall of the temperature of the air they breathe. I have known in my experience several instances in which this sudden change has been sufficient to cause dissolution during the act of sleep.

CHAPTER XII.

DEATHS AND CHIEF CAUSES OF DEATH IN ENGLAND AND WALES IN THE YEAR 1880.

In order to bring to a full conclusion the part of this work relating to causes of disease, I add, on the suggestion of my distinguished friend, Mr. Edwin Chadwick, C.B., a table constructed for me, by Mr. Mundy, of the Registrar-General's Office, of the causes of the mortality of England and Wales in the year 1880.

The table thus presented is, in the main, a copy of a similar one constructed by Mr. Chadwick, from the returns of 1847, an abstract of which table is also added for the purpose of comparing the relative mortalities of two equal periods separated by the span of thirty-three years. On comparing the two years we see that the proportion of deaths from different classes of disease has slightly varied. The zymotic diseases, relatively to total deaths, have decreased in 1880 in the proportion of 3.17 per cent.; consumption has decreased in the proportion of 3.55 per cent.; diseases of the digestive organs in the proportion of 1.08 per cent. On the other hand, diseases of the respiratory organs, irrespective of consumption, have increased 5.64 per cent.; diseases of the brain, nervous system, and senses, 1.58 per cent. Other causes remain nearly the same.

DEATHS AND CHIEF CAUSES OF DEATH IN ENGLAND AND WALES IN THE YEAR 1880.

(*Compiled from the 43d Annual Report of the Registrar-General.*)

DEATHS AT THE SEVERAL GROUPS OF AGES FROM THE UNDERMENTIONED CAUSES, AND PROPORTIONS OF DEATHS AT EACH GROUP OF AGES TO 100 DEATHS AT ALL AGES: ALSO MEAN AGE AT DEATH BY, AND MORTALITY FROM, EACH CAUSE.

Causes of Death.		Ages at Death.															Mortality to 1,000,000 persons living.	
		Under 1 year.	Under 5 years.	5–10	10–15	15–20	20–25	25–35	35–45	45–55	55–65	65–75	75–85	85–95	95 and above.	All Ages.	Mean Age. (yrs. mo.)	In the year 1880.	Average in 5 years. 1875–79.
All Causes..........	Number	134,686	224,441	19,352	9,139	11,765	13,806	29,097	33,643	36,389	46,257	53,190	40,506	10,472	567	528,624	29 11	20,506	21,250
	Proportion	25.46	42.47	3.66	1.73	2.23	2.61	5.50	6.36	6.88	8.75	10.06	7.66	1.98	.11	100			
Zymotic or Epidemic, Endemic, and Contagious Diseases.																			
Typhus	Number	9	58	59	58	59	66	85	82	60	29	13	4	—	—	573	27 4	22	44
	Proportion	1.57	10.12	10.30	10.12	10.30	11.52	14.83	14.31	10.47	5.06	2.27	.70	—	—	100			
Enteric Fever	Number	93	968	838	725	897	728	968	627	455	288	182	33	1	—	6,710	23 10	261	300
	Proportion	1.39	14.43	12.49	10.81	13.37	10.85	14.43	9.34	6.78	4.29	2.71	.49	.01	—	100			
Simple continued Fever............	Number	58	465	232	116	88	73	122	84	96	108	91	33	3	—	1,511	23 4	59	81
	Proportion	3.84	30.78	15.36	7.68	5.82	4.83	8.07	5.56	6.35	7.15	6.02	2.18	.20	—	100			
Scarlet Fever.......	Number	896	11,204	4,837	765	210	137	156	70	18	7	—	—	—	—	17,404	5 4	677	718
	Proportion	5.15	64.37	27.79	4.40	1.21	.79	.90	.40	.10	.04	—	—	—	—	100			
Remittent Fever....	Number	—	—	6	19	4	3	16	14	8	3	2	1	—	—	76	29 10	3	3
	Proportion	—	—	7.89	25.00	5.26	3.95	21.05	18.42	10.53	3.95	2.63	1.32	—	—	100			
Puerperal Fever	Number	—	—	—	—	67	377	777	423	15	—	—	—	—	—	1,659	30 6	65	70
	Proportion	—	—	—	—	4.04	22.72	46.84	25.50	.90	—	—	—	—	—	100			
Small-pox..........	Number	78	170	76	49	65	62	102	71	30	15	7	1	—	—	648	20 0	25	82
	Proportion	12.04	26.24	11.73	7.56	10.03	9.57	15.74	10.96	4.63	2.31	1.08	.15	—	—	100			
Measles	Number	2,730	11,178	928	99	40	21	28	19	10	4	—	—	1	—	12,328	2 7	479	342
	Proportion	22.14	90.68	7.53	.80	.32	.17	.23	.15	.08	.03	—	—	.01	—	100			
Diarrhœa...........	Number	18,440	25,998	226	46	32	50	129	169	218	520	913	926	286	6	29,519	8 4	1,147	782
	Proportion	62.47	88.06	.77	.16	.11	.17	.44	.57	.74	1.76	3.09	3.14	.97	.02	100			

Dysentery..........	Number	138	199	13	3	9	15	51	54	69	86	102	54	11	—	666	38	5	26	26
	Proportion	20.72	29.88	1.95	.45	1.35	2.25	7.66	8.11	10.36	12.91	15.32	8.11	1.65	—	100				
Rheumatism	Number	8	51	197	259	289	229	403	402	341	462	503	195	23	—	3,354	42	0	130	147
	Proportion	.24	152	5.87	7.72	8.62	6.83	12.02	11.99	10.17	13.77	14.99	5.81	.69	—	100				
Other Zymotic Diseases.............	Number	11,958	24,854	2,163	363	194	204	599	771	796	783	630	346	50	4	31,757	8	10	1,236	1,293
	Proportion	37.65	78.26	6.81	1.14	.61	.64	1.89	2.43	2.51	2.47	1.98	1.09	.16	.01	100				
Total Zymotic Diseases.............	Number	34,408	75,145	9,575	2,502	1,954	1,965	3,436	2,786	2,116	2,305	2,443	1,593	375	10	106,205	10	4	4,130	3,888
	Proportion	32.40	70.75	9.02	2.36	1.84	1.85	3.24	2.62	1.99	2.17	2.30	1.50	.35	.01	100				
Consumption.......	Number	976	2,602	1,196	1,782	4,492	6,120	11,592	9,586	6,191	3,320	1,165	150	4	1	48,201	32	11	1,875	2,117
	Proportion	2.02	5.40	2.48	3.70	9.32	12.70	24.04	19.89	12.84	6.89	2.42	.31	.01	.002	100				
DISEASES OF THE RESPIRATORY ORGANS.																				
Pneumonia.........	Number	5,632	12,265	906	286	469	658	1,527	2,085	2,048	2,238	1,800	784	97	3	25,166	24	5	979	1,035
	Proportion	22.38	48.74	3.60	1.14	1.86	2.61	6.07	8.28	8.14	8.89	7.15	3.12	.39	.01	100				
All other Lung Diseases.............	Number	18,625	31,278	936	253	305	361	1,242	2,503	4,519	8,153	10,585	7,218	1,408	65	68,826	34	4	2,677	2,947
	Proportion	27.06	45.44	1.36	.37	.44	.52	1.80	3.64	6.57	11.85	15.38	10.49	2.05	.09	100				
Total Lung Diseases	Number	24,257	43,543	1,842	539	774	1,019	2,769	4,588	6,567	10,391	12,385	8,002	1,505	68	93,992	31	8	3,656	3,982
	Proportion	25.81	46.33	1.96	.57	.82	1.08	2.95	4.88	6.99	11.06	13.18	8.51	1.60	.07	100				
Diseases of the Brain, Nerves, and Senses	Number	21,369	29,970	1,851	923	868	833	2,056	3,306	4,843	7,619	9,860	6,339	884	12	69,364	32	7	2,699	2,813
	Proportion	30.81	43.21	2.67	1.33	1.25	1.20	2.96	4.77	6.98	10.98	14.22	9.14	1.27	.02	100				
Diseases of the Digestive Organs....	Number	3,818	5,193	618	425	517	545	1,463	2,385	3,517	4,413	4,064	1,733	187	9	25,069	42	2	975	1,003
	Proportion	15.23	20.71	2.47	1.70	2.06	2.17	5.84	9.51	14.03	17.60	16.21	6.91	.75	.04	100				
Accidents or other Violence.........	Number	1,903	3,905	1,080	817	1,015	1,040	2,011	1,899	1,987	1,721	1,206	662	140	7	17,490	31	10	680	744
	Proportion	10.88	22.32	6.17	4.67	5.80	5.95	11.50	10.86	11.36	9.84	6.90	3.79	.80	.04	100				
Other Causes.......	Number	47,955	64,083	3,190	2,151	2,145	2,284	5,770	9,093	11,168	16,488	22,067	22,027	7,377	460	168,303	37	5	6,491	6,703
	Proportion	28.49	38.07	1.90	1.28	1.27	1.36	3.43	5.40	6.64	9.80	13.11	13.09	4.38	.27	100				
Mortality from all causes to 1,000 persons living at each group of ages.		153*	64.4	6.3	3.3	4.8	6.1	7.7	11.5	16.0	30.4	61.2	131.3	257.9		20.5	—		—	—
†Cancer............	Number	11	50	30	36	58	76	471	1,692	2,941	3,690	3,001	1,106	124	3	13,278	57	6	516	493
	Proportion	.08	.38	.23	.27	.44	.57	3.55	12.74	22.15	27.79	22.60	8.33	.93	.02	100				

NOTE.—The heading "Other Zymotic Diseases" includes chiefly Diphtheria (2,810 deaths), Croup (3,571), Whooping-Cough (13,662), Erysipelas (2,053), Cholera (797), Syphilis (2,162), Want of Breast Milk (1,827), Purpura and Scurvy (935), Alcoholism (950), and Thrush (1,276). The Zymotic class is divided into four orders, viz.: Miasmatic, Enthetic, Dietic, and Parasitic. "All Other Lung Diseases" includes Laryngitis (1,831), Bronchitis (57,939), Pleurisy (1,310), Asthma (2,145), and other forms of Lung Disease (5,601). The term "Other Causes" embraces chiefly Gout (644), Dropsy (3,192), Cancer (13,278), Mortification (1,411), Scrofula (3,735), Tabes Mesenterica (9,536), Hydrocephalus (8,514), Heart Disease and other diseases of Circulatory Organs (34,768), Diseases of Urinary Organs (10,761), Diseases of Generative Organs (1,293), Diseases of Organs of Locomotion (2,322), Diseases of Integumentary System (1,982), Premature Birth and Diseases of Development and Decay (73,135).

* *Proportion to* 1,000 *children born alive.*

† Cancer, although included in "other causes," has been here specially extracted.

SUMMARY COMPARISON OF THE DEATHS IN ENGLAND AND WALES FROM THE PRINCIPAL CLASSES OF DISEASE IN THE YEARS 1847 AND 1880.

CAUSES OF DEATH.	Deaths, 1847.	Deaths, 1880.	Proportion to 100 deaths from all causes.	
			1847.	1880.
Zymotic Diseases	97,924	106,205	23.26	20.09
Consumption	53,317	48,201	12.67	9.12
Diseases of the Respiratory Organs	51,115	93,992	12.14	17.78
Diseases of the Brain, Nerves, and Senses	48,574	69,364	11.54	13.12
Diseases of the Digestive Organs	24,492	25,069	5.82	4.74
Accidents or Other Violence	12,917	17,490	3.07	3.31
Other Causes	132,638	168,303	31.50	31.84
ALL CAUSES	420,977	528,624	100	100

NOTE.—The numbers are not *strictly* comparable owing to slight differences in classification: for instance, Teething was classed with Digestive Organs in 1847, while in 1880 it would come under Other Causes; Delirium Tremens was classed with Nervous Diseases in 1847, but with Zymotics in 1880.

BOOK III.

PART THE SECOND.

A PRACTICAL SUMMARY OF PREVENTIONS OF DISEASE.

CHAPTER I.

INTRODUCTORY NOTES.

It was stated in the introductory portion of this third book, that, although there were, nominally, over a thousand diseases affecting human kind, the number of diseases which called for special notice might be reduced, practically, to a little over one hundred.

If we could prevent, therefore, from ninety to a hundred of the diseases which make up our mortalities, we should compass the prevention of almost the whole field of disease, since we should incidentally learn how to prevent or remove most of the minor diseases, which do not kill, by the same effects of prevention.

Commencing the study of prevention we may then limit our observations to the comparatively few diseases which are most prevalent and most fatal.

In dealing with this limited number of diseases, in respect to the means necessary for their prevention, we may again reduce them to groups according to their causes, because we shall discover, if we simply turn back to the pages of the history of disease, that preventive measures group themselves into natural position by the side of causes. Thus, to take one example, almost all the class of diseases grouped under the head of *zymotic* demand similar principles of treatment in relation to their prevention.

The chapters which are to follow will consist of a series of practical summaries relative to preventive measures. In these chapters I shall consider the question of prevention as connected with the varieties of origins and causes of disease, with the object of indicating how those origins and causes may best be averted or stopped altogether.

There are three grand agencies to be taken into account in

the numeration of all measures of prevention. I may call these the *personal*, the *municipal* or *local*, and the *central* or *governmental* agencies. By the personal I refer to the influence which every individual or person may bring to bear for the prevention of disease in himself, or in those who immediately belong to him. By the municipal or local I mean those agencies for prevention which are brought into action through the instrumentality of local or municipal boards in their localities. By the central I mean those agencies which spring from the central government, and which are intended to apply to the country altogether, to local government, and equally to personal responsibility and authority.

Of these three agencies the first is, according to my view, by far the most important. It is so important that if, as an agency, it could be made perfect, all else would sink into mere nominal position, or would, at most, consist of formal administrative labor. As, however, it is impossible to secure such personal perfection, the two other agencies are, perforce, demanded, and of these two the local is in my opinion pre-eminent.

The local government of the place is the health of the place. Each place must be ruled into health by those who know, and know best, the wants, the necessities, the feelings, and the failings of each individual centre. To try to make all the separate centres and towns of our land perfect in salubrity by directions and instructions from a central government control is to give up permanent local reform in this direction altogether. There are in a locality sufficient obstacles in overcoming mere local traditions and sympathies to render hopelessly impossible urgent reform pressed from a distant quarter where there is no local knowledge of sympathies and no sympathy with them.

For the local work there must be the local power; power which the local authority shall be proud to exercise with knowledge and wisdom; power which shall be in its way competitive, and which shall have the effect of stimulating competition until health, like leaven, has leavened the whole of the national life.

At the same time in every country there should, no doubt, be a supplementary governmental or central board. A central board of reference; a board competent to speak with authoritative advice in general questions; a board that could arbitrate between conflicting opinions and would be open to be consulted on dis-

puted points; a board which, by its *personnel*, would command the respect of the nation, and confer scientific dignity on the nation in the presence of other nations; and, a board to which other nations organizing a national health advancement could refer. Such a central board in England, at the seat of government, would be invaluable. Here, however, its duties should end. It should rule, not govern, be at once the greatest and the least of the sanitary authorities. It should be a centre exhibiting to the nation and to the world the widest, to the particular locality the narrowest, range of action.

Sometimes, in treating on details of prevention, we shall find that all these agencies are required to be brought into operation in order to secure prevention. At other times one only or two may be required; but in every case the first or personal agency will be demanded. I shall, consequently, in each succeeding chapter take the personal consideration first, and the local and central, when they come into requisition, in the second and third place respectively.

CHAPTER II.

PREVENTION OF HEREDITARY CONSTITUTIONAL DISEASES.

I.

Personal Rules for Prevention.

The prevention of descent of disease by hereditary taint can only be systematically secured from its origin by such measures as shall arrest or check the intermarriage of disease. By most persons it is supposed that this mode of prevention is necessary only for persons of the same kindred. The theory is true and untrue. It is quite true when it applies to the marriage of persons of the same family, such as cousins, if the members of that same family are affected with decisive taints of disease, for then the taint is intensified by such marriage should progeny be the result. On the other hand, if the members of a family be perfectly healthy, and free of taint of disease, marriage taking place among the members of that family, within the legalized limits, instead of being attended with bad results in regard to progeny may be attended with the best results. In other words, mere consanguinity is not the determining cause of descent of disease, and parents who have charge of those who are marriageable, or marriageable people themselves, need not consider consanguinity an objection unless it carries with it constitutional defect. In all cases reasonable people should give no countenance to marriages where there is definite indication of constitutional affection on both sides, even though the constitutional affection shall not be the same on each side; since some crosses of disease are quite as serious as the double hereditary infliction of the same disease. A reference to the chapter on hereditary causes will make this matter sufficiently clear.

Rules for an Expectant Mother.

In all cases, whether tendency to hereditary taint be great or small,—it is never, perhaps, actually absent,—special care ought to be taken with women who are about to become mothers. There is no part of the preventive art which calls for more care than this. There is no practice that is more seriously neglected. Amongst the poor we often see women laboring at the hardest tasks, subjected to the most painful annoyances, anxieties, and troubles, up to the very moment when the pains of labor are coming on. Amongst the wealthy and well-to-do we see women pursuing occupations and often wearying pleasures, giving way to caprices, or exposing themselves to fatigues, or being subjected to trouble and sorrow, up to the same period. This is all as wrong as can be, and when the fact is recalled that during all the period previous to its birth the unborn child is dependent for its life-blood on its mother, the commonest sense not less than the commonest humanity comprehends how everything that tends to reduce the vitality of the mother tends also to reduce the vitality of the offspring, and to render it the more liable to suffer from the effects of hereditary or transmitted taints of disease.

For my part I do not know which suffer most, the poor women or the rich women, during these most critical and important periods of their lives; but, on the whole, I fear the wealthy are the worst affected, and that indulgence is more injurious than poverty.

Amongst both classes certain simple rules should invariably be followed. The diet on which the expectant mother subsists should be of the simplest and least stimulating character. Animal food in the way of flesh should not be taken more than twice per day, and always in moderation. Alcoholic drinks and tea should be strictly avoided, the drink diet being made to consist of milk, milk and water, cocoa, and similar nutritious and unstimulating fluids.

Next to these attentions in respect to diet matters of exercise and rest should be carefully considered. Daily out-door exercise, to the extent of not producing extreme fatigue, is essential. But this should be alternated with the most careful attention to rest. Every night bed should be sought at an early hour, and never less than nine hours for sleep should be taken. The bedroom

should be well ventilated and of equable temperature, a temperature of 60° Fahr. being a good standard. The bed-clothing should be warm but light, and the bed should be exclusively occupied by the woman herself.

In daily life all scenes leading to excitement of mind, emotion, passion, especially passion of fear or anger, should, to the fullest possible extent, be avoided. Influences telling through the mother on the child during the stages of development inflict, I am quite confident, upon the developing child nervous impressions which are never eradicated.

The clothing of the expectant mother requires special care, since, under the present system, it is the worst that by any mortal ingenuity could be devised. The clothing should be loose, light, warm, and borne entirely from the shoulders; anything like tight bands or corsets round the body are equally injurious to mother and to child.

Lastly, the expectant mother should, of all persons, be protected from exposure to infectious disease, because, as we are now well aware, such disease may be directly communicated to the unborn.

I have reduced these rules to the fewest possible and to the most elementary form, so as to render them plain and easy to every class. They are very simple; they are entirely natural; and, being followed, would largely prevent the many dangers incident to hereditary proclivity.

Rules for Infancy.

The infant, so soon as it is born, should be warmly wrapped up and kept warm. Warmth is essential to its life. It should be washed as soon as possible with warm water and soft flannel.

After the first washing, the infant should have a warm bath twice a day, one in the morning and one in the evening. The water should be pleasantly warm to the hand—not hot, but lukewarm. The body should be washed, while in the bath, with a piece of soft flannel, which should be changed for a new piece every week at least. The washing should be conducted gently and rapidly, a little plain soap being used. After the washing, the body should be well dried with a warm soft cloth or towel. The washing should be continued every day, with careful drying and gentle friction.

From the first, the dress of the child should fit loosely and easily. Tightness of the dress anywhere is very bad. Tight swathing of the body and limbs by many bands of cloth or flannel, —swathing-bands,—is the worst thing that can be done. It checks free breathing and circulation of the blood, chafes the skin, pinches, and causes want of comfort and rest.

The clothing should be light and warm, and it should cover all the body, except the head, face, and hands. Light soft flannel, having a smooth surface, should be put next the skin. The feet should be clothed in warm woollen socks and shoes. The clothing should always be kept as clean as can be, so that it never has a bad smell nor shows patches nor spots of dirt. The body linen of the child should not be washed with soda.

So soon as the infant is washed and dressed, it should be put to the mother's breast. The mother and child both get good from this plan. If the mother has little milk, the act of putting the child to the breast will tend to cause a flow of milk; and, if the infant gets milk direct from its mother, it will not require opening medicine. The infant will live best, and ought to live solely, on breast milk for six months; nine months will not be too long.

If the mother fail to supply milk from her own breast, and if there be no wet nurse, the child should be fed with cow's milk diluted with water. One part of pure cow's milk and two parts of water is the best mixture, to which a little sugar, one teaspoonful to a quarter of a pint, may be added. As soon as ever it is possible, the infant should have its natural breast milk; and should that not be quite sufficient in quantity it should be supplemented with cow's milk, diluted with water as above.

It is wrong to give up breast milk because the supply from that source is not enough. The milk given in addition to breast milk should be warmed before it is given as food. As the child gets older, the quantity of cow's milk may be increased and the water lessened. At two months, the cow's milk may be increased to two-thirds, water one-third. At six months, the cow's milk may be used without water.

After six months, the infant may begin to be weaned; but there is no cause for hurry, and if the child is at the breast for nine months it will take no harm. At nine months it should be weaned.

Weaning should be carried out gradually, and the milk food should be replaced by something similar. The best substitutes are whole meal, wheaten porridge, and oatmeal porridge, with fresh milk. Until the first set of teeth is complete, no other kinds of food are required. The practice of giving infants bits of animal food, animal soups, or puddings is most injurious.

Intoxicating drinks of all kinds are most poisonous to infants. Any terms less strong than this, as applied to the drinks, would be under the truth. No such drinks should ever be given, either with or as food. Tea and coffee should never be given to children.

After the child has cut all its first teeth it may begin to take light solid food. Good bread, small portions of well-cooked animal food, light custard puddings, and fresh fruits, are the best foods in early life. Under a prudent system, animal flesh may be dispensed with, as well as intoxicating drinks. Oatmeal and wheaten porridge with milk are still the best staple foods.

The feeding of children as of infants should be at regular intervals. They should be fed about every three hours in the course of the day.

Care should be taken that the infant does not suck its thumb or any solid substance. This practice is bad in two ways. Of a certainty, it causes pain in the stomach, and disturbance of the bowels. It also gives rise to after deformity of the mouth. Nearly all grown-up persons who have their upper front teeth too prominent and angular, with a deep hollow in the roof of the mouth, have caused that deformity by sucking the thumb when they were infants, and the deformity is hereditary.

The infant should from the first be taught to sleep in its own little bed or cot. In its first days it should be allowed to sleep when it likes, and indeed it may pass three parts of its life in sleep. It should be trained to go to sleep at regular hours at night. Its bed should be very soft, so that the little body finds rest on every part.

The infant should be put into a warm bed, and be kept warm during sleep. It should not be excluded from the air, but should sleep in a pure warm atmosphere, and be well covered with light warm bed-clothes. The air of the room should always feel comfortably warm. If a thermometer be used, it should indicate not less than 60° and not more than 65° Fahr.

All artificial plans and practices of causing sleep are bad. The infant should go direct to its rest. Walking about with it, rocking it, jogging it, are bad habits. Once taught these habits, it soon fails to go to sleep without them, and they create much disturbance of sleep, with dreams and startings, which lead to feverishness and fretting the next day. Soothing sirups, laudanum, poppies, and all sleeping drugs are most injurious as means for producing sleep, and should only be used under competent medical advice. They ought to be excluded from the houses of all persons who call themselves respectable, except when wanted, under medical direction.

The sleep of infancy should never be disturbed by noises and sudden surprises. It is most hurtful to take up an infant from its quiet repose to show it to strangers, or to amuse it in gas-, candle-, or lamp-light. It is desirable that the sleeping-room or nursery should not only be warm, but quiet, spacious, and well aired. Anything that causes a bad smell should not remain in the room for a moment. The room should never be darkened. The cot may be shaded from direct light, or the light may be shaded from the little sleeper by a curtain; but the sunlight, when it is present, should always be let into the room. Sunlight cheers, exposes dirt, and purifies the air.

The infant should be taken out into the air every day, except when the weather is wet or very cold. It does the infant no harm for it to sleep when it is out of doors, if it be well wrapped up. The exercise out of doors should be long before night, and at times when the weather is most agreeable, not too hot and not too cold. In winter, the infant should go out twice a day if it be possible, once as a matter of course. In summer, it may live out of doors in the best parts of the day. When out of doors, the infant should be well protected from the cold in winter and from the heat in summer. In winter as well as in summer light-colored clothing is best for it. In the summer, its head should specially be shielded from the direct rays of the sun.

The infant life should be one of quiet all the day and all the night long. An infant ought never to be exposed to sudden noises and starts. An infant should never be taken into great crowds or tumults, nor into public noisy meetings and amusements. Many of the painful impressions which are felt in after life, and which cannot be traced to any direct origin, are inflicted in the

period of infancy, when the mind receives but does not remember the fact of receiving the impressions.

Infants should not be shouted at nor scolded, nor in any way frightened. They suffer intensely from sudden alarms and fears, and may become nervous for life by such injuries. A baby should never be struck nor subjected to any punishment of that kind. It should always be made as happy as it can be. Then it is likely to grow up disposed to be blessed with a cheerful disposition, which will make it happy in itself and a source of happiness to all around it.

The infant should never be lifted up by its arms, or made to stand just on its toes while partly lifted. It should on no account be placed too early on its feet to stand or to walk. By placing it on its feet too early the child is apt to get bow-legged, and sometimes weak or deformed in the back. As a rule the child itself learns, naturally, to acquire the art of standing and walking, and it should be left to itself so to learn.

Those who are nursing the young from their own breast, should be kept as free as is possible from anxiety and care, and should be encouraged to be all day cheerful and happy. The impressions they make on the child are often life-long.

Nursing women and mothers should be well but not richly fed. They should have four light meals a day, abundance of milk, fresh fruit, and, in fact, generous food. They may take tea and coffee in moderate quantity, but every stimulant of an alcoholic kind, such as ales, stouts, wines, and spirits, should be avoided. Stimulants injure the nurse, the mother, the infant. They can be easily substituted by milk, maltine, oatmeal-porridge, and other harmless and truly sustaining foods.

Every mother, who is not actually in bad health, should nurse her own child. This is a duty, not to the child merely, but to the mother. It is health to both.

Rules for Childhood.

The first rule for childhood relates to the feeding. This should be at once simple and efficient. The meals should be at regular hours and at periods of three or, at most, four times a day. Animal food, with the exception of milk, should not be taken more than twice per day, and judicious preference should

always be given to carefully selected vegetable foods and fruits. The liking of children for fruits is a natural desire, and with care to see that the fruits are clean, ripe, but not over-ripe, and fresh, this liking should be encouraged. The child should be taught to cease to eat so soon as it feels satisfied. The foods chosen for it should include those which provide for all the animal wants; colloidal foods, for building up the active structures of the body; mineral foods, for building up the passive structures or bones; hydro-carbon foods, for supporting the animal warmth; and water, for supplying the natural fluid food by which all the other foods are carried and distributed.

All stimulating beverages, alcoholic drinks in every form, should be strictly avoided. Tea and coffee should also be withheld.

The dress in childhood should be warm, light, loose, and should be made to assimilate as nearly as possible, in shape and form, for both sexes. All dresses which compress the growing body; all dresses which muffle up some portions of the body closely and leave other parts, such as the legs, arms, and breasts, uncovered, are a mistake. The clothing should be so adapted as never to be an encumbrance to the movements of the limbs or to the movements of the respiration. It should be carefully adapted to the seasons, on the rules to be described in the next chapter.

In childhood there should be free exercise both of body and mind, sufficient exercise without enforcement of it. Every simple bodily exercise which brings into play the muscles of the limbs, which causes the lungs healthily to expand, which encourages free circulation, which entices natural appetite, which keeps all the natural functions in order, and which keeps the mind happy and cheerful, is excellent. Whatever goes beyond this in the way of physical exercise, whatever leads to physical strain, is injurious and provocative of constitutional disease.

All mental strain in childhood is exceedingly mischievous in effect. The mind should be left free to grow with the body, and lessons should be permitted rather than enforced. Lessons communicating knowledge should be of the simplest and most practical kind, after the manner of the Froebel or Kindergarten system, in which the mind is educated through all the senses and with pleasurable emotions. In a word, nothing tends more to prevent the development of constitutional disease than the natural and

healthy development of the nervous system, without strain or worry.

The repose of childhood by sleep requires to be carefully tended. During the whole period of childhood, which we may consider to extend to the fifteenth year, ten hours of sleep should be encouraged. Each child should sleep in his or her own bed; this is a vital point. The bedroom should be well ventilated, pure, light, cheerful, and of equable temperature, 60° Fahr. The bedding should be elastic, so that the body reclines altogether and not on parts of its surface. The bed-coverings should be light, porous, warm, and spotlessly clean. Perfect quiet in the bedroom is essential for the healthy sleep of childhood, since every unnecessary disturbance of sleep is against nature.

Children should be very carefully taught to carry out all natural habits with regularity and cleanliness. They should be particularly instructed to attend to the action of the bowels at one particular time each day. They should also be taught the habitual practice, common amongst the Jewish people, of ablution afterwards. They should further be brought into the regular habit of the morning bath, so that they may feel that the day has not been properly commenced until the bath has been taken.

Connected with morning and evening habits they should be instructed at night to turn their clothes inside out, and lay them in systematic order so that they may be aired during the night, and turned and cleaned previous to dressing on the following morning.

The mind during childhood should be kept free from all mental impressions of fear and disquietude. Stories of ghosts and such-like absurdities should be kept always from the young. The child should also be held free from excitements springing from details of crime or tragedy of any kind.

Lastly, children should be scrupulously protected from exposure to the contagious diseases, physical or moral. Their time of life is that in which such contagions act with greatest effect, and numbers of the after physical evils to which they may be liable are called into action by the results of these contagious influences. The vulgar idea, which some persons hold, that children ought to be submitted to contagious diseases because they must, almost of necessity, pass once through the ordeal, is most reprehensible.

Rules for Adolescence.

All the rules which have been stated as applicable to childhood are, in the main, equally applicable to the period of adolescence. Some of these, however, require to be particularly enforced, while one or two require to be added. The diet should be as simple and regular as in childhood, and the avoidance of all stimulants should be carried out with equal resolution. It is unfortunately in this period of life that the habit of resorting to alcoholic beverages is most frequently acquired, hence the reason why this habit should be specially guarded against. If it be not guarded against, the stimulant, in no sense whatever a necessity, soon begins to be considered as such, and leads to a system of false dependence upon it which becomes one of the most dangerously disposing causes of constitutional affection.

In this same period of life another habit is apt to be acquired which should never be acquired. I refer to smoking. Of the bad effects of this habit I have treated at pp. 359–363. The first symptoms induced whilst acquiring this habit ought of themselves to be sufficient indication, to all wise adolescents, of the evils which spring from it.

The same rules which are applicable to physical and mental strain in childhood are applicable at this period. Physical overstrain, mental overstrain, the all but certain producers of constitutional mischiefs, should specially be prevented. Every thoughtful person who wishes well for the future of his kindred should oppose with the most resolute determination the competitive freaks and insanities which are now the fashion of the hour. With their utmost energy thoughtful persons should oppose the current cramming system of so-called education, and the extortionate examinational aberration which brings the cramming system into existence. The result of extreme mental pressure is already bearing fruit. It is not raising the culture of the nation in any sense. It is unfitting manhood and womanhood for good, steady, and progressive work, and it is keeping alive, actively alive, the constitutional proclivities to nervous and mental disease. It is particularly mischievous to young women who are to become the mothers of a future generation.

Rules for Mature Life.

For the prevention of development of hereditary diseases in persons of mature age, an adhesion to many of the rules already given are as necessary as in earlier life, while some few others are demanded.

Continued temperance in respect to alcohol is essential, in addition to which other kinds of temperance are called for. Self-possession and mastery over the passions or emotions is, with a mature man or woman, one of the choicest safeguards against the inroad of constitutional disease. Freedom from ordinary passion of anger protects both the nervous and vascular systems. Freedom from extreme competitive strife and the worry dependent upon it protects largely from two of the constitutional diseases to which many persons are predisposed,—tubercular disease and cancer. Freedom from restless worry, excitement, and speculation protects in the most signal manner from those premature degenerations of heart, brain, and glandular organs such as the kidneys, which lead to organic death, in so many instances, during the middle age of man.

The reader will observe for himself that the rules for prevention against hereditary and constitutional evils are all personal rules, and are such as generally belong to the first, second, and third stages of life. In later stages active proclivities to constitutional affection become much modified, and such distinct hereditary affections as cancer often run a slow and comparatively painless course. No new rules for prevention under these circumstances call for description.

CHAPTER III.

PREVENTIONS OF ATMOSPHERICAL, METEOROLOGICAL, AND CLIMATIC DISEASE.

I.

Personal Rules for Preventions.

Rules for the Various Seasons.

The first personal rule for preventing diseases from seasonal influences should be based on the facts collected by Mr. Milner, and epitomized at pp. 526–7. It should be remembered that the body becomes heavier during the summer months, lighter during the winter months, and that the changes from gain to loss are abrupt, the gain beginning about the end of March, and the loss in September.

The practice springing from this knowledge should bear on *foods*. The proportions of all foods should increase somewhat, in September, and be maintained so as to meet waste up to March. The kind of food that requires to be most increased is that which sustains the animal warmth. Starchy foods, such as potatoes and rice; fatty foods, such as butter, and animal fats and oils; and saccharine foods, such as common sugars, jams, and honey, may be increased in quantity. On the other hand, with the turn of the month of March such foods may be decreased, and may be taken in much more moderate quantities during the succeeding months up to September.

Owing to the circumstance that during the heat of summer there is very free perspiration and extreme loss of water from the body, there is often great loss of water weight, and the body seems to lose both in substance and weight. The fact leads many to consider that because of the apparent wasting, excess of food, and of rich food, is called for. This is an entire mistake. In

warmth the body requires less food, though it may require a little more watery drink. In warmth rich foods are not digested and assimilated, and a great deal of the dyspepsia and bowel derangement in the summer season arises from over-feeding, in ignorance of these facts.

Attention to *clothing* should also be connected with these general changes of season. As September advances, additional clothing should be assumed, and should be fully maintained until the season of waste. It is good practice to continue the warm clothing well into the period of return of the gaining season, and indeed not to make any important change until April has passed away. The warmth obtained by clothes should not be attended by great weight of clothes. The warm winter clothing should be porous and light; the knitted Shetland woollen clothing is the best example that can be given of what is required. During the summer months the light clothing should also be of porous texture.

During the wasting months the *bodily exercise* should be less severe than in the gaining months, and excessive strains or sudden demands on the bodily powers should be particularly avoided. This same rule extends to *mental exercises*. Both rules are of special importance in regard to the young, and equally in regard to those who have passed the meridian of life.

During the wasting period longer hours of *sleep* and *rest* are required than in the warmer months when the disposition of the body is to gain in weight. All through the winter season half as much sleep again is necessary compared with what is wanted in summer. Other things being equal, six hours of sleep on midsummer night are equal to nine on midwinter night. Prolonged hours of sleep in summer are prejudicial; short hours of sleep in winter are prejudicial. These rules are peculiarly applicable to the young and to the old.

The temperature of the *bath* should be regarded in respect to season, if any variation be desired. As a general thing, it is good practice to find an agreeable temperature for the body and to keep to that all the year round. But those who like to have a cold bath for a portion of the year should limit that portion to the seasons when the body is naturally gaining weight, the cold bath being very hazardous during the months when the process of waste is in progress. A strong man in the prime of life may bear it for some years and feel a pleasure in the reaction; but

even he is easily chilled by it when his nervous system is depressed, and he is never wise in holding rigidly to the practice. To the young, the old, and the feeble, and to the members of the female sex at all ages, the practice is an unsafe one. From May to September the cold bath may be permissible, but as soon as the wasting period begins the temperature of the bath water should be raised, so as not to produce a chill when entering it.

Rules for Special Seasonal Changes.

Let it be remembered that there are six special periods characterized by special conditions of atmospheric temperature and moisture; namely, a first period of *dampness* and *cold;* a second of *cold;* a third of *dryness* and *cold;* a fourth of *dryness* and *warmth;* a fifth of *heat;* a sixth of *dampness* and *warmth.* Let it also be remembered that each of these periods is marked by particular diseases.

The above rule applies to London in so far as accurate investigation has up to this time been pursued. But probably in most civilized parts of the world a similar division is equally traceable.

In the period of dampness and cold, extending in this country from the last week in October to the third week in December, the best preventive rules consist in keeping, as far as possible, in a dry and warm atmosphere; in excluding moisture from the house, especially from the bedroom; and in avoiding bodily contact with damp clothes and bedding. In this period the body should be kept warmly and lightly clothed, and the feet should be well shod. What is called waterproof clothing is, however, best avoided, except in the form of a very loose cape. A good umbrella is much safer and better than a waterproof. The diet should be sufficient but unstimulating.

In the period of cold, extending from the end of December to the third week of February, a period in which throat and chest diseases begin to be easily developed, and in which diseases of the respiratory organs show the greatest mortality, the chief rule is to keep up the animal temperature by good food, and complete avoidance of depressing alcoholic drinks, to conserve animal warmth by warm clothing, and to conserve nervous power by taking a full allowance of sleep. These three rules should be rigor-

ously observed by the strongest men if they mean to retain their strength, and by the weaker if they mean to retain their life.

In the third period, that of dryness and cold, extending from the last week of February to the second week of April, the depression of body is greater than at any other time. The condition of dryness and of cold is most exhausting in itself, and caps, if I may so say, the two preceding periods of exhaustion. It is the nervous system now that suffers, and diseases dependent on nervous depression are dominant. The practical rule in this season is to maintain the animal warmth; to avoid night air; to avoid excess of every kind; to avoid great trials of strength, physical and mental; to live well; and, to take abundant rest. The lessons of school-children ought to be considerably reduced during this season.

In the fourth period, that of dryness and warmth, extending from the third week of April to the fourth week of June, life is beginning to return, and the healthiest season of the year is presented. The practical rules now are gradually to lighten the clothing, to reduce the hours of sleep, to reduce food, and reasonably to increase work, mentally and bodily. At this time the best work of the year ought to be carried out, in private as well as in public life.

In the fifth period, that of heat, extending from the end of June to the end of August, affections of the alimentary canal, bowel complaints, and some affections of the head have to be guarded against. The clothing should be light and porous, the hours of sleep reduced to a moderate minimum, and the hours of exhaustive labor of mind and body fairly limited.

The most important rule at this season relates to diet. The diet should be moderate in quantity, should be well cooked, should be mainly a cold diet, and should always be composed of fresh food. The greatest care should be taken that the water used as drink should be fresh and pure. Acid and effervescing drinks are inadvisable, and all alcoholic beverages are most pernicious, from being the most common promoters of liver and intestinal disorder. Indulgence in fruit is permissible, so long as it is moderate, when the fruits are quite fresh and are neither under nor over ripe.

A further important rule in this season is to protect the head from the direct rays of the sun. In sending out infants and children the strictest attention should be paid to this precaution.

In the period of dampness and warmth, extending through September and three parts of October, a healthy seasonal time is presented. In this season the simple rules of practice are to avoid damp, and to pursue so regular a diet that the danger of intestinal disturbance, still present, may be avoided. This is a period in which good bodily and mental work can be carried out with facility. It is an excellent period for travel and for recreation out of doors.

Rules Irrespective of Seasons. Protection from Damp.

In all seasons it is essential to insure protection from damp. Damp beds have always been considered dangerous, and linen that has not been put to the fire to air and take off damp is usually avoided. A great deal more than these measures, which in their way are excellent, calls for attention. The damp house is the source of greatest danger. All precautions should be taken to keep atmospheric damp from the house. The stone or brick work of the building should not be porous, so as to hold moisture; the walls of rooms should not be covered with material that will absorb and hold moisture; the basement should be perfectly dry, so that from it damp and impure air do not rise into the rooms above. Properly, the basement of every house ought to be raised from the earth underneath by an arch, so that air can flow beneath it. Cellarage under a house should be well ventilated and kept dry. The roofs and gutters of the house should be made water and damp proof in their relations to the interior of the building. As a certain rule, when moisture streaks the walls and banisters of a house, and looking-glasses are easily dimmed by moisture, the house is unfit for habitation.

The soil on which a house is built modifies, naturally, the facility for saving the house from the bad effects of atmospheric moisture. The choice for selection of site should be a porous or gravelly soil, through which the water can percolate rapidly and make free escape. This may be considered the most perfect site. Houses constructed on clay or impervious soils are unfortunately placed in this respect, but the dangers can be largely prevented

by thorough drainage and by raising the dwellings from the earth. Sites of impervious stony structure are bad. These sites are most difficult to drain, and from the surface of them, with each rise of temperature, the evaporation of water is exceedingly rapid. Thus in cold seasons they are cold and damp, in warm seasons they are warm and damp.

The worst site of all is perhaps the undrained, soft, spongy soil on which so many new houses are heedlessly constructed. These houses are never truly dry. It is as if they were built on sponge, and Mr. Chadwick, in denouncing such constructions as causes of many of the diseases which lead to the highest mortalities, understates, I believe, rather than overstates the fatal evil.

The plan of securing the most complete subsoil drainage for every human habitation is therefore necessary as a precaution against the dangers of atmospheric damp.

Trees in and about habitations are good and bad. They are good when they are so placed as to purify the air by the breathing function of their leaves; when they protect from harsh winds like the east and northeast winds; and when they afford protection in hot weather from the sun. They are injurious when they surround a place so completely that they shut out the air, prevent escape of moisture, and interfere with the entrance of light. The dead leaves of trees are also a source of danger around a house in the damp and cold season of the year.

Trees, consequently, should be so placed in respect to a residence as not to interfere with air, evaporation of moisture, light, or atmospheric purity.

Sunlight.

As much sunlight as can be obtained should be allowed to enter into every room of the dwelling at all hours of the day, and the light should only be subdued when it is painfully strong or oppressive. Sunlight purifies, and is a potent agent for destroying the action of the organic poisons which float in the air. Let a beam of sunlight traverse a room from an opening in a shutter, and if the course of the beam is not filled or made bright with a cloud of specks of dust, the air is comparatively clean. If, on the other hand, the beam is loaded with floating particles, the air is unclean and unfit for healthy respiration, for those particles enter the lungs at every breath, interfere with respiration, and are

obstructive of circulation. Such particles may carry with them the organic matters which constitute the virus of the contagious diseases.

The electric light might often be used with advantage for testing the purity of the air of a house, a hospital ward, or other places where people live.

Freshness of Air.

The air admitted into a dwelling-house should always be as pure and as fresh as it can be. Air that is breathed over and over again is devitalized, and in such air there is not only risk of accumulation of the products of combustion, fumes of gas, and odors of decomposing organic substances, but the air itself is deprived of its full power to vitalize. As a rule, whatever is producing an unpleasant or oppressive smell, however faint, in a house or in a room, is doing harm to the air of that house or that room, and should be at once removed. Dead flowers, preserved or stuffed animals, remains of food, should never be kept in rooms the air of which is used for the purposes of life. Bedrooms should of all rooms be free of such impurities; they should be as free as they can be even of furniture that is unnecessary, and should never be the respositories of soiled or left-off clothes, or other similar sources of uncleanliness. They cannot be too efficiently ventilated.

Preventions in Relation to Climate.

Places that are damp are always bad as localities for human habitations. There is no exception to this rule. Some diseases are closely connected with dampness of climate, pulmonary consumption especially; hence the residence of consumptive persons in close and wet valleys is most injurious to them. The same fact applies to those who suffer from the disease rheumatism, and, indirectly, from heart-disease consequent upon the rheumatic affection.

The climate that is on the whole best suited to man is one of comparative dryness and warmth. The climate of May and June in this country is therefore the most favorable, and it is a good thing to remember so simple a lesson derived from the calculations of scientific inquirers.

To those in England who can afford to take a change of cli-

mate, and feel that they require such change, it is excellent practice for them to observe which of the six climates of England, the damp and cold, the cold, the dry and cold, the dry and warm, the hot, and the damp and warm, is most injurious or most beneficial. They can, in this way, find out what seasons of the year require to be avoided, and by reference to technical information as to foreign climates, can discover which climate is the one to be sought for by way of change. There is in the United Kingdom itself a great variety of climate, and by care in selection many persons might find what they want here, who now, with an imperfect knowledge, go, after what they think they want, to other countries, where many of the conditions of health are less favorable than those obtainable at home.

The question of residence in a valley or on a height, or on the sea-level, is one of much moment. Taking it all round, I believe that the sea-level in an open space is the best. It is assumed by some that certain races can bear variations from the sea-level, above it and below it, better than other races, and the Jewish race has been cited as peculiarly favored in this respect. The evidence in proof of this is insufficient, while it is very strong in favor of the advantage of the sea-level surface. Much of the benefit of a sea-voyage, in many cases of disease, depends on the equality of atmospheric pressure, as well as on the purity of the atmosphere.

With most persons residence at an elevation of a hundred feet or so above the level of the sea gives a sensation of lightness and activity, and is, no doubt, much preferable to residence below the sea-level.

Occasional change from the crowded city or town to the sea-side is, to the vast majority of people, one of the greatest of benefits. By such change the blood is newly aërated, and the lungs, to use a familiar expression, are cleared of the dust and *débris* of the populous place. I am of opinion that three or four short visits to the sea-side in the year are productive of far more good than one prolonged visit extending over the same time.

II.

Local and Central Preventions of Atmospherical Causes of Disease.

Local sanitary authorities ought to do a great deal for the atmospheres of towns by attending to the proper planting of trees in open places, the introduction of parks and squares, and the immediate removal of all sources of atmospheric impurity. They ought to provide also proper shelters for the protection of those who are, by necessity, engaged in public out-door work, such as cabmen. They ought to provide gymnasia and winter gardens for the poor, and especially for the children of the poor. They ought to protect from the dangers of lightning shock by erecting lightning-conductors on all public buildings. But their first and greatest care should relate to the subsoil drainage of the locality which is under their direction. Everything is literally and practically mere surface work until all the area covered with houses is rendered dry and efficient for carrying away moisture.

The Central Government has duties to perform in specially enforcing subsoil drainage, and in giving the local authorities powers to enforce the use of none but proper materials in the construction of human dwellings.

The Central Government has still another duty before it, that, namely, of legislating more scientifically and determinately for the suppression of noxious exhalations and vapors in large manufacturing centres and industries. There is nothing whatever to prevent every industry from being carried on without causing any impurity of air, except the one difficulty of deficient resolution. Science has at command every means of suppressing noxious vapors and of making industry more profitable when the expenses incident to the reformation have been met. It is the duty of the Government to employ science to discover the methods of reformation, and to supply standards by which the authorities can insist that all work shall be carried on by such standards, until the air of every affected town in the kingdom is freed of atmospheric impurities.

CHAPTER IV.

PREVENTIONS OF PARASITICAL DISEASE.

For the prevention of all the parasitical causes of disease there is one sole method, a method which is as effective as it is simple, and that is to be clean; for the diseases induced by parasitic growths of all kinds, with one or two partial exceptions, are due to uncleanliness.

For the prevention of those diseases from parasites which enter the body by the alimentary canal, and which give origin to hydatids, tape-worm, and trichinosis, cleanliness in respect to food is the desideratum.

For the prevention of diseases, like scabies, from those parasites which affect the surface of the body, systematic general ablution is the means required.

For the prevention of cutaneous diseases from vegetable parasites, like the diseases ring-worm and scald-head, protection from contagious influence, sustainment of the general health by correct diet and *régime*, are, in addition to cleanliness, the measures demanded.

In carrying out these preventive measures personal and local authoritative action are both required.

I.

Personal Rules for Prevention.

Personal cleanliness is called for in respect to the cleanliness that should be followed in the preparation of food in every household. Foods are the grand means for the introduction of parasites, and butcher's meat and pork-butcher's meat are the commonest means.

All specimens of animal food which present signs of being spotted or speckled should be rejected. If in the flesh small rounded white spots be observed, the meat should be rejected. If connected with a portion of flesh there be minute bladder-like

structures attached, the substance should be rejected. If the meat, especially pork, present what is called a measly appearance, or, as it is sometimes commonly described, "a pepper and salted look," in lines or sections, it should be rejected. If it presents the appearance of anything living in its structure it should be rejected.

The greatest care should be taken that all foods, whether animal or vegetable, be thoroughly clean before they go through the process of cooking if they are going to be eaten cooked; still greater care should be taken with those articles of food of a vegetable kind, such as celery, radishes, onions, and the various kinds of fruits, which are going to be eaten uncooked. With children unclean fruits are a constant cause of disease, particularly of that parasitic disease caused by the *ascaris vermicularis*, or thread-worm. I believe, also, that the large round worm *ascaris lumbricoides* is often introduced by fruit.

When the intestinal parts of animals are being used as food, as in the case of tripe, too much care cannot be taken in regard to cleanliness. Such foods are very doubtful altogether, but if they are to be utilized it should be with more than ordinary preventive care. The same rule applies to the liver, a structure which is an easy channel, as food, for the propagation of disease among those who subsist upon it.

In regard to every kind of animal or vegetable food that may be a means of conveying parasitic forms into the body, there is another rule which should be universally adopted, and that is, to have *such food thoroughly and completely cooked.* No animal food ought to be eaten that has not been subjected to the temperature of boiling water, that is to say, 212° Fahr. It should be subjected to this temperature through the whole of its structure, whether it be boiled or roasted. It is probable that all the parasitic organic forms are destroyed at this temperature of 212°, and the actual fact of complete boiling is preventive of itself. But roasting when effectually carried out is a still better preventive.

Preserved meat, even when the preservation from decomposition is perfect, is not a sufficient protection against the introduction of parasites, and indeed the parasite of the disease *trichinosis* has been more frequently distributed through preserved hams and such kinds of food than by any other means. Pre-

served foods, as well as fresh, require, therefore, to be kept under observation for the sake of prevention of disease.

Foods, vegetable or animal, in a state of decomposition ought to be rigorously excluded. The idea that some foods can be taken when they are what is called "high," and when they are charged actually with low forms of animal life, is a fallacy as uncleanly as it is dangerous. Such food, high game, high venison, is altogether out of place at a table surrounded by those who wish to be healthy.

For the prevention of those diseases of the cutaneous surface which spring from parasitic forms, such as scabies, two rules are necessary. The first of these is to prevent contact of the healthy with the unhealthy. The second is to maintain perfect cleanliness of body. These rules extend to the prevention of all the living animal forms which move upon the surface of the body, or which burrow under the surface.

For the prevention of the diseases which spring from the low forms of parasites, such as ring-worm and scald-head, three rules, as suggested already in general terms, are required. The first rule is to prevent contact of the healthy with the affected, a rule which should be rigorously carried out in nurseries and school-rooms whenever any cases of the affections appear. The second rule is to maintain the general health of the young in whom these diseases are most common, and who become more than ordinarily liable to them when, from exposure to close and bad air, indifferent diet, or overwork mental or physical, the vital powers are deteriorated. The third rule is to maintain perfect cleanliness of the body.

II.

Local Authoritative Rules for Prevention.

Local authorities have at command powers which should enable them to unite their authority with that of personal care for the prevention of the parasitic diseases. These, in fact, are just the diseases which a local authority can control.

In every locality local authority ought to have an inspector of animal food, whose duty it should be to see that no part of a carcass of an animal should enter the market if it present any evidence of being tainted with disease.

This is a practical fact which has been known to the Jewish people for ages past, and has been acted upon by them with the utmost benefit to the health of their community.

In the Jewish community there is a certain number of men set apart to act as inspectors of animal food. They attend at the slaughter-houses, and after an animal is slain and dressed they submit it to inspection; then, unless they put upon it their sign that it is free of disease, which certainly excludes all parasitic disease, it is not permitted to enter a Jewish family. It enters into the families out of the Jewish community, so that we, who are not Jews, actually accept into our bodies food which the Jews have rejected as diseased food.

It may be true that the Jewish inspectors are not skilled pathologists; it may be that they sometimes make mistakes, condemning as unfit for food what is only seemingly unfit; but when they err it is on the safe side, and to what extent they reject food which other members of the community accept is shown by comparing a statement of the number of animals slaughtered for the Jewish community in the London districts, with the numbers that were free from disease and diseased. The facts, collected by Mr. H. Harris, Secretary to the Jewish Ecclesiastical Board, have been supplied to me by Mr. D. Tallerman.

Animals inspected in London by the Jewish inspectors yielded the following returns:—

In 1878 (55 weeks).

Total Oxen	*22,308*
Free from disease	14,423
Diseased	7,885
Total Calves	*3,330*
Free from disease	2,545
Diseased	785
Total Sheep	*41,556*
Free from disease	28,537
Diseased	13,019

In 1879 (50 weeks).

Total Oxen	*22,387*
Free from disease	12,856
Diseased	9,531
Total Calves	*3,691*
Free from disease	2,663

In 1879 (50 weeks).

Diseased	1,028
Total Sheep	*38,302*
Free from disease	26,476
Diseased	11,826

In 1880 (July 1 to December 25, 25 weeks).

Total Oxen	*13,116*
Free from disease	6,973
Diseased	6,143
Total Calves	*1,964*
Free from disease	1,330
Diseased	634
Total Sheep	*19,743*
Free from disease	14,208
Diseased	5,535

These figures, which refer to animals slaughtered at Deptford and Whitechapel alone, are of themselves sufficient to show that a considerable amount of diseased animal food is sold to, and consumed by, the British community outside the Jewish pale. The returns include animals rejected for pleuro-pneumonia and some other diseases of the lung. But I have found, by conversation with the Jewish inspectors, that in a very large number of instances the obvious and commonly known forms of parasitic disease, in animals killed for human food, are those which they detect, and for which they exclude such food from the market.

The rule, therefore, I suggest is one founded on the Jewish system. The rule is that so long as the consumption of animal food continues the local authorities should provide a well-trained inspector, whose duty it should be to see that every animal carcass entering the market for human food is free of disease.

The labors of such an official should, I think, extend also, in a properly constituted place, to the public fruit and vegetable markets, so that no articles of food should be exposed there for sale except when properly cleansed from parasitic forms of life and other evidences of uncleanliness.

To prevent the occurrence of parasitic diseases affecting the skin, it is incumbent on each local authority to supply to the people, by means of public baths, every possible facility for cleanliness by ablution. In towns this is recognized partially. In villages it is unrecognized practically. It ought to be recognized universally.

CHAPTER V.

PREVENTIONS OF ZYMOTIC DISEASES.

At first sight it would appear to be an incredible task to suppress the great class of diseases which come under the head of diseases of zymotic origin; and yet it is true that these diseases are, of all those of natural origin, the most distinctly preventable. For this reason they are sometimes specially called *the preventable* affections.

In applying the preventable measures necessary for this task we may, fortunately, lay aside all reference to the controverted points relating to the nature and origin of the affections. We have only to remember and keep in mind three admitted facts: (1) That the diseases are communicable from an affected person to an unaffected who is susceptible. (2) That the virus or infecting matter, whether it be living or dead, is *particular*, and transmissible for short distances, from the affected to the unaffected, by the air, by water or watery fluids, and by attachment to solid substances, as clothing or materials of the house. (3) That a person having been subjected once to these diseases is, as a general rule, protected for a certain time from their recurrence.

In the work of preventing the zymotic diseases all the agencies under command are required. There must be personal endeavor, there must be local authoritative endeavor, there must be central authoritative endeavor all acting in harmony together.

I.

Personal Rules for Prevention.

Removal of Contagious Material. House Drainage.

The first personal rule for prevention is to take every precaution not to let susceptible people, and especially the susceptible young, be exposed to the contagion of the zymotic diseases. Thus

in all schools where the young congregate, as well as in families, if a zymotic affection attacks one member, the others should be removed from the affected and placed, as safely as possible, away from the danger.

The next important rule is that every house should be so arranged as not to be in any way favorable to the retention or distribution of contagious material. This implies, as a basic principle in domestic sanitation, the taking care that everything that is generated in the house, and that is of an excretive, offensive, and injurious nature, shall be prevented accumulating in the dwelling. Whether it be dust, refuse, remnant of food, or sewage, it is necessary that it be removed as it is produced.

The foundation of this principle is laid in the *drainage* of the house. Unless a house be so drained that it is absolutely cut off from the sewer into which its contents are discharged, it is not a healthy house. Unless a house be so drained that the emptying of its sewage is an immediate process, so immediate that as the sewage is poured forth it finds its way from the house direct into the sewer, the house is not a healthy house.

This rule also implies that it is essential that all pipes leading into or from a house should be within ready reach, and should always be open to view in their course. The main soil-pipe should at all times, where it is possible, be on the outside of a house; it should be open at the upper part, and, under proper arrangement, it should also be open at the lower part. But, if it be impossible to have a pipe outside the house and readily accessible there, if the pipe must be inside the building, so much the more important is it that it should be in sight throughout its course, and so accessible that at any moment it can be reached. To enclose a soil-pipe in a wall in such a manner that it can only be examined after days of work and a vast amount of costly destructive mischief, is the worst plan that can be adopted. Clear throughout its entire course, the pipe should also be open to the air at the top, and in the lower part or basement of the house should be made to enter a space, which in its turn is open to the air, so that the collection and retention of gases is impossible anywhere, and any pressure of gas is equally impossible.

This rule, again, implies that care must be taken, in respect to the drainage of the house, that the contents discharged from the sewer be carried away in the escape-pipe from the house in the

most perfect and rapid manner. All intercepting catch-pits, all and everything that can by the merest accident hold and retain the sewage, must be completely rejected.

Equal care must be taken that the soil-pipe from the house into the sewer shall not itself become like a sewer, from being too large to be completely flushed. As a rule, a pipe four inches in diameter is of sufficient size to convey away all the contents of an ordinary house, of a house, for example, that can comfortably accommodate ten persons. For a house used only as a dwelling-house a six-inch pipe is sufficient for a family of larger size, the rule being, *cæteris paribus*, that the smaller the tube the more complete and certain is the flushing and cleansing. The pipe properly selected in respect to its size should be laid in such a manner that it is open at both ends. It should start from the open space into which the descending pipe from the house pours its contents; and, outside the house, before it enters the sewer, it should have an ascending branch for communication with the open air. When these precautions are used there can be no accumulation of sewer gas and no pressure of gas between the descending house-pipe and the sewer.

Lastly, this rule implies the necessity for the precaution of making the pipes which convey the sewage from the house perfect, in and throughout their course, so that there shall be no leakage by the way. The sewer pipe should be as perfect in this respect as the coal-gas pipe. Up to the present time that result has not been achieved, though we are now making close approaches towards it. I leave it as a matter yet unsettled, even amongst the most eminent practical sanitarians, what material is best for the soil-pipe,—earthenware, iron, glass. My impression is, that iron, or glass of sufficient strength and well jointed, would be by far the best material. It would be impermeable and lasting, and glass would show the facts of obstruction and accumulation wherever they might occur. The tube running from the descending pipe into the sewer ought always, when it is practicable, to be carried outside the dwelling, and in entering into the sewer from the house, it ought to be securely trapped between the opening immediately outside the house and the sewer.

A house drained on these principles is as entirely cut off from the sewer and from sewer emanations as if it were set on a mountain-side and were drained into the open air at a distance

from it. So ought every house to be drained. It is criminal to let disease enter any house by that hitherto grand staircase for disease,—the passage from the sewer.

Isolation of the Sick. The Sick-room.

When disease of a zymotic character has broken out in a house, and the sick person has to remain in the house, he should be separated from all the rest and placed in a room specially prepared for his reception. The room selected should be at the top of the house, and free from all unnecessary articles of furniture, curtains, and hangings. The walls and ceiling should be carefully brushed down, the floor dry scrubbed with sawdust, and the dust products burned. A fire should be kept burning at all times in the room whilst the patient remains in it. Even on warm days the ventilation secured by a free and unobstructed chimney-draught is of untold value. Cupboards within the room should be emptied and used as little as possible.

Air, without draught, should be freely admitted, together with daylight whenever that is attainable. The old-fashioned practice of keeping up darkness in the sick-room, except in special diseases, such as those affecting the eyes or the brain, is one to be condemned. The face of the sick person may be shielded from all glare, but his room should be exposed to the purifying influence of the clear light of day. The admission of light is particularly essential in the case of infectious diseases, because light is a destroyer of the virus of disease.

The temperature should be kept up equably at a mean of 60° Fahr.

The bed should be protected from draughts. It is best placed, as a rule, between the door and the fireplace, except in cases of small-pox, when it should be in the centre of the apartment, with the head directed towards the window, by which means the sufferer is screened from direct light.

It is wise to exclude from the sick-room all vessels containing water, and to bring them freshly into the apartment, each time, when required for ablution or for drinking. The presence of a steamy vapor in the sick-chamber is always productive of evil: and is only permissible in cases of bronchial affections and other diseases affecting the organs of respiration.

No food should be allowed to remain in the room, and it is

wise to insist that the nurse or attendant shall take her meals in a separate apartment.

The attendants upon the sick should be as few as possible, and dressed, suitably, in garments made of light-colored washing material. Dark and sombre dresses have a depressing effect, and are to be avoided. A patient, particularly in the convalescent stages, progresses most favorably in an atmosphere of cheerfulness. A little alteration in the arrangement of the room, the admission of freshly-cut flowers, the placing or changing of a picture, or any similar improvement likely to give pleasure to the invalid, are incentives to happiness of mind, and are specially agreeable when the senses are awakening from depression to their original activities.

Removal of the Infected Sick.

A question is often raised as to the time when a person recovering from infectious disease should be removed from his room. On this subject Dr. Squire has given some admirable recommendations, which I may thus epitomize.

The diseases of the zymotic class which are tabulated at p. 591 as having a short stage of incubation, have a prolonged convalescence, and remain long as sources of contamination. These, therefore, are safest when kept at home and in their own room until convalescence is complete. Scarlet fever is a good illustration of this practice.

Those diseases in the same table which show a long period of incubation give, as a rule, a quicker convalescence and a more rapid freedom from danger as sources of contamination. These, therefore, may be removed more quickly, and with less danger to themselves and others. Measles is an illustration of this practice.

The above rules are not without their value in regard to the separation of the sick from the healthy at the commencement of the outbreak of a contagious affection. In the case of the diseases of short incubation included under the two first groups of the table of p. 591, it is good practice to remove the healthy from the affected immediately. It is also safe practice to remove in the diseases named in the third series. To remove in the fourth or long incubation class is less important, and if the sick person has to be removed far away it may be very prejudicial.

Purification of an Infected Room.

After a sick-room has been occupied by an infected person, it should be purified as follows:—

Let everything that can be done be done within the room itself.

Make a large fire, close the door very completely, and open the windows widely, or even take out the sashes altogether, and cleanse them and their framework thoroughly.

Put on the fire everything that admits of being instantly destroyed.

Pack up carefully and closely every article of clothing and bedding that is to be conveyed away for disinfection by heat. A light iron trunk, such as is commonly employed for travelling by sea, is the best for packing up infected garments. If the clothing is to be cleansed by washing it should be dipped into cold water, and carefully wrung out and packed while damp in the above-named air-tight trunk. By this means the spread of infection during transit to the laundress is prevented. The laundress should be instructed to plunge the clothes into *boiling* water, and after boiling them for fifteen minutes to cover them closely until cold. The garments may then be washed in the ordinary way.

Cleanse the walls and ceiling of the infected room; strip off the wall-paper, and treat with two coats of distemper. Brush the floor and wood-work free from dust, and burn the dust. Then wash the floor thoroughly all over with a solution of oxychlorine, one part to forty of water, finishing with clean water.

To make all sure, diffuse iodine vapor or sulphurous acid gas through the apartment. The room may then be considered effectually disinfected.

II.

Local Authoritative Rules for Prevention.

It should be the business of every local central authority to apply the same preventive measures for the protection of the community at large as the householder applies to his small community.

Removal of Contagious Material. Town Drainage.

The first rule is to drain thoroughly. Every single house ought to be cut off from its sewer. Every town ought to be cut off from its sewage.

For perfection of drainage and sewerage, the separate system, that is, the removal of the sewage and all water used for domestic purposes by a distinct series of drains and sewers, and all storm water by another and distinct system, is essential. Between sewage and storm water there should be no possible connection. At whatever preliminary cost, the sewage should be exhausted from the town with a known quantity of water admitted for domestic purposes and none other.

If natural advantages lie ready for this exhaustion, let them be used. If, however, there be no such natural advantages, they should be thoroughly provided by an artificial exhaust method by which the sewage can be lifted so clean away, that, as it is removed, all foul air from every house can be carried away also, and every closet and every drain be flushed with air as well as water, in one unchanging out-of-the-town direction. With well-arranged small sewer pipes and with steam power for exhaust power when that is called for, there probably is no place that cannot be cleansed of its dead and dangerous matter minute by minute every minute of the year. With complete arrangements, thus carried out, there is no need for special sewer-ventilation for any house or building. Each house is cleansed at all times, and every opening from it, connected with the main system, is a point where flushing commences. Every house, in a word, is a house that is always being purified of all the impurity it engenders that can pass away by a sewer.

When this result is obtained, a town is as near to safety as it can possibly be from a whole class of zymotic diseases ; and, other things being equal, there has been effected in it nearly half the reform that is required for making sure of the natural death-rate of a model community.

When, by the separate system, sewage is mixed with a limited quantity of water, there are four modes of removing it from the town.

1.—By utilizing it on a farm.

2.—By pouring it into a stream or the sea.

3.—By utilizing it with dry earth.

4.—By collection and removal in floating tanks.

Respecting these plans:—

The sewage farm plan is excellent when the conditions are favorable, that is to say, when the farm is large enough to utilize all the sewage, and is sufficiently removed from a living community not to cause impurity of the air of that community.

The plan of pouring the sewage into open streams and rivers is very bad. The sewage pollutes the stream and the fertilizing products are lost. In sea-coast towns it is better to pour into the sea, and this is sometimes necessary, though it entails loss of product.

The dry earth plan, where it can be carried out, is excellent, and for small towns and villages and agricultural districts is perhaps the most natural and the safest that could be devised.

The collecting tank plan is a design for meeting all the difficulties connected with the above-named systems.

I suggest that for a town placed near a river or canal, the said river or canal should still be the means of transit, but that it should not be polluted as a stream. To obviate the pollution I would have receiving floating tanks on the canal or river, in or connected with a steam barge provided with a pump for raising the town sewage into the receiving tanks and for steaming away with the fertilizing material to depots in the course of the river, where the material could be applied directly, or after preparation, to the purposes of agriculture.

In sea-side towns the plan could be carried out by sending the floating tanks, by sea, to barren coasts, where now no land is cultivated. Here the meadow and cornfield could rise up, and add not only food for the grosser appetites of the people, but finer scenery to the landscape.

In many instances in the inland districts of this country the empty coal-barge, going back from the great centres of life to be refilled with common fire-food, could, by a simple change in construction, be made applicable for carrying or towing the tank containing the fertilizing food-making material for the human fire.

In places where there is no canal and no river for their conveyance, the sewage tanks might, if rendered perfectly air-tight, be removed by night railway train to any destination where their

contents could be applied to agricultural purposes. By this plan the whole of the fertilizing sewage of the country could be put to its natural and economical use.

Removal of House Refuse.

The regular removal of the refuse from houses in towns and the destruction of it is another duty which is almost everywhere urgently demanded. The dust-bin in which the refuse of the house is allowed to accumulate for several days is a persistent nuisance and danger in most populous communities. Each day each house ought to be cleared of its dust and its organic refuse, and that refuse buried, in agricultural districts in the earth, on coast districts in the sea.

In inland districts in places of large population the refuse should be transported by railway to its destination. In no place should it remain a centre of nuisance and danger as a huge ash-pit.

Public Water Supply.

Another duty connected with the local authority consists in supplying its community with a perfectly pure water, a water derived from an independent source, entirely disconnected from every kind of sewage contamination, and in such abundance that each person shall have sufficient—30 gallons—per day for his or her personal wants. The water should possess the following qualities:—

(*a*) It should be free from all impurities, organic and inorganic.

(*b*) The supply to every house should be constant.

(*c*) There should be no partial dependence for it on wells. Wells for individual residences, used or not used according to individual taste or caprice, should certainly all be closed, except in cases where the distance of a residence from a central supply is too great to enable the central supply to be utilized.

(*d*) The supply should be constant from the main or reservoir to the house, and always laid on, so that there is no cistern storage of water in any house.

Supervision of Milk Supplies.

After the water supply, which in past days has been a frequent source of communication of the zymotic diseases, the milk supply of the place should be most carefully supervised. Cow-

sheds in the midst of human communities, in which cows, like animal machines for producing milk, are kept, perhaps for months together, in partial darkness, dirt, close air, and often without any provision for the separation of healthy from unhealthy animals, should be entirely abolished. Milk supplies, like meat and vegetable supplies, should be under systematic supervision.

Provision of Public Laundries.

Each local authority should take care to provide for its district, or to see that there is provided in it, model laundries and drying-grounds.

Double injury springs from the present system of laundries. In the small houses of the poor in which so large an amount of laundry work is going on, the atmosphere is overcharged with moisture, and the poor children of the workers are exposed to many acute diseases, especially to croup, from this cause. That is evil number one. Evil number two is more extended and extensive: it is the danger, always imminent,—from the laundry in which there is no separation of infected from uninfected clothing, and no disinfecting chamber for infected clothing,—of the poisons of the infectious diseases being conveyed by clothing into the homes of the healthy, an accident which is easy to accomplish, and often accomplished.

Hospitals for the Infected Sick.

For the care of those who are stricken with the zymotic or contagious diseases each local authority should have within its boundaries a small hospital, and if the place be large a series of small hospitals, ready at every moment for the reception of the infected sick from all classes of society, rich as well as poor. Such hospitals should be under the control of the local central authority, and each should be constructed to receive not more than twenty to thirty sufferers at one time, so that spread of infection by concentration of the sick may not occur. In crowded places these hospitals should, in my opinion, be placed on the same level as the roofs of the houses ; they should be constructed of iron, so that their walls may be purified by the fire brush and all organic matter from the sick instantly destroyed.

The hospitals thus planned, and made entirely safe from becoming sources of danger to the general community, should be in

the midst of the community. First, because it is bad practice to remove the sick long distances; and, secondly, because every person in whose house a case of infectious disease breaks out should be induced, by example, not to have the sufferer taken away a long distance, but removed close at hand to a proper place provided with every means for the most scientific treatment while isolated from the rest of the community.

Under this plan every private house would cease to be a centre of infectious disease; every person accidentally attacked would be removed out of harm's way; and every person so removed would be placed under the best circumstances to secure recovery. Amongst the poor children suffering from contagious disease, the mere matters of equable temperature and proper feeding in such hospitals would alone suffice to reduce the mortality from the infectious maladies fully one-half what it now is.

In connection with this department for the management of the infectious sick, the local authority should have a meteorological observatory in order to detect the relation of seasons and of all known atmospherical variations to disease. It should keep curve charts of current diseases after the method introduced by Messrs. Mitchell and Buchan, of the Scottish Meteorological Society. It should instruct its sanitary inspectors to sustain the strictest police observation as to the development of infectious disease in different centres of the community; and whenever a centre was found to be steadily yielding a number of cases exceeding a certain standard, it should remodel that centre, and if absolutely necessary should carry out to the letter the old Mosaic system of pulling the infected part down and reconstructing it in a condition for health. It should have the most accurate registration of diseases at all times, throughout all the boundaries under its jurisdiction.

Under this system every parish would bear its own burden and accept its own responsibility for the retention and management of the infectious cases occurring within its own boundaries. It would have all the special centres of infection in each of its districts thoroughly mapped out, and would know, on a calculation of cases occurring in quinquennial periods, what is the permanent accommodation required for its infectious sick.

The general supervision of this work should be in the hands of the Medical Officer of Health.

The nursing, also under the supervision of the Medical Officer of Health, should be carried out by trained nurses, who might be educated to their work in the Union Infirmaries. The medical attendance should be conducted by a special staff of duly qualified medical men, acting under the Medical Officer of Health, and responsible to the local authority.

III.

Central Authoritative Rules for Prevention.

When all that can be done by personal effort is done, and when personal effort is backed by local administrative authority, little remains for a central government to perform. And, as a central government is comparatively powerless in a free country, unless it be acting in accordance with the will of the people, it has but little to do with matters in which the people are ready to act for themselves. On the subject of the prevention of zymotic diseases there are, however, a few rules required which can only be carried out by the central authority.

Registration of Disease.

The registration of births and deaths which has been going on since 1838 has proved the most valuable record extant of the nature, course, and progress of the zymotic diseases. That ought now to be supplemented by a registration of those diseases, so that we may not only see what those diseases pay over to death, but what health pays over to them. I suggested this work of registration to the Government nearly a quarter of a century ago. I also organized a voluntary plan of such registration, and with over fifty stations, extending in different points of the country from St. Mary's, Scilly, to the Shetland Islands, carried on the plan for some years. The details were placed by me before Sir Benjamin Hall when he was President of the Board of Health, and obtained his strong approval. But the project lapsed, and although it has been carried out in some particular localities, under local authority, it remains yet to be brought into a general scheme in the United Kingdom and to be affiliated with the present work of the Registrar-General.

Through the registrars of births and deaths these returns of

disease should now be collected. A law is required rendering it necessary for every householder to make a return of the contagious disease which is present in his house. The return should go regularly to Somerset House, and should be embodied, systematically, in a weekly statement.

Collateral returns relating to the meteorology of districts in which the diseases occur, and of epidemic diseases of cattle, domestic animals and plants, should also be collected. From such returns, coupled with complete geological survey of the districts, we should, in a few years, possess a perfect natural history of the spreading diseases. We should know precisely their modes of origin, their course, and their relations one to another, as well as their mortalities, from which facts we should soon learn how to prevent them altogether.

Compulsory Prevention. Vaccination.

The compulsory enforcement of measures for preventing disease on what are called prophylactic principles is a subject which has led to the active administration of the Government in regard to one particular disease, Small-pox. The Government enforces vaccination as a prophylactic measure against small-pox. Some years ago that measure was made compulsory by Parliament, with the assent of the greater part of the nation that had paid attention to the question involved. Of late years a very powerful opposition to vaccination has been started, and active measures have been taken by many energetic and conscientious men to bring about a repeal of the compulsory act. It is important to place this question in a true and impartial light.

There is no doubt from the evidence at command that the disease Cow-pox, which is induced by vaccination, prevents those who have suffered from it from contracting the more severe disease small-pox. Again, there can be no doubt that cow-pox itself, pure and simple, that is, uncomplicated by any accident, is a harmless disease, while small-pox is one of the most serious. As a matter of exchange, therefore, of one disease for another, presum ing that one or other must be had, cow-pox has everything in its favor.

Again, admitting that cow-pox is attended by certain accidents, by the introduction into the body of erysipelas, syphilis, and some other diseases, if the choice of two evils be an absolute necessity, the balance is all on the side of vaccination.

The next point then which we have to discuss is whether small-pox must exist if cow-pox be not compulsorily enforced?

To understand this question we must consider on what ground vaccination stood when it was first introduced.

Vaccination was brought in by Jenner in order to supersede a process called inoculation for small-pox, a process by which small-pox was systematically propagated from one person to another by operation. This began in the early part of the last century, and became so general it may have been considered all but universal. A few years before the close of the century a census was taken of Brighton and of some other towns, as preparatory to a general inoculation of the people. In this way every village and every town, we may almost say every house, became a centre of small-pox, because wherever the disease was propagated by inoculation it was also propagated by infection. It was at this period, when the country was saturated with the contagious disease, that Jenner came forward with his antidote, and it is not in any way surprising that by his substitution of a comparatively harmless inoculation for a terribly fatal one, he changed the state of things altogether, and created a triumphant success for himself which no one could dispute.

That which remains to be determined is, whether by this success he merely corrected an egregious blunder in assumed prophylactic practice, or whether he went further, and introduced a plan for preventing the natural disease, irrespective of the mischiefs produced by inoculation.

The truth lies probably between the two extremes. The most determined opponent of vaccination must acknowledge, if he will be fair, that Jenner, in substituting vaccinia for variola, cow-pox for small-pox, substituted a protective disease against small-pox which in itself was harmless, and which had this indescribable advantage, that the protective disease, unlike small-pox, was not of an infectious or contagious character, except when it was promoted for a distinct objeet by a specific operation.

The effect of this introduction was, naturally enough, stupendous. If inoculation had been given up, small-pox would have continued in the most wide-spread manner, because the disease was everywhere, and every dwelling was so infected with it that nothing short of insusceptibility to the affection by the process of contracting it could be considered as protective, while every per-

son who took the disease became another instrument for its propagation. In a word, the whole population was obliged to have small-pox, and I remember myself being shown by a relative of mine, who entered the practice of medicine before vaccination was accepted, a large village where every resident in it had, without a single exception, been through the small-pox. Vaccination swept this away. It afforded a protection; it did *not* afford an infectious disease. It checked the universal evil; it gave time for the general disinfection of the country from small-pox poison. Its good effect was so immense that all secondary evils incident to it were naturally overlooked.

So much for the original value of vaccination. It has played a most important part, and has, in all probability, by giving time for general removal of small-pox poison from the homes of the people, brought the suppression of small-pox within the range of sanitary measures alone, without necessitating, for many years longer, the enforcement of vaccination.

The opponents of vaccination wish it to be accepted that that time has now come. They direct our attention to Jurin's and Nettleship's remarkable computations about the mortality of small-pox before the introduction of inoculation, and they urge that the mortality from small-pox of persons who take the disease after vaccination is not greater than that of persons who, in the old times, died from the original small-pox, namely,—18 per cent.

What Jurin said was the following:—

(*a*) That of all children that are born in England at the time he wrote, 1722, there will at some time die of small-pox *one in fourteen.*

(*b*) That of persons of all ages taken ill of the natural small-pox, there will die of that distemper *one in five or six, or two in eleven*, or just over 18 per cent.

(*c*) That of persons of all ages inoculated for small-pox, without regard to the healthiness or unhealthiness of the subject, as was practised in New England, there will die *one in sixty.*

(*d*) That of persons inoculated with the same caution in the choice of subjects as has been used in England, there will die of the inoculated *one in ninety-one.*

In these notes we see why inoculation became popular. It seemed to produce amongst the inoculated a great reduction of mortality, and if it had not at the same time produced an infective

disease, which raised the general mortality from the infection, it would have been a blessing of no mean kind. As it was, it was a disaster which vaccination signally corrected.

In this day we have got over that disaster so far, that if throughout our towns we had proper hospital accommodation for the reception of all small-pox cases so soon as they occur, and means for the complete destruction of the virus which each case reproduces in such abundance, we could soon stamp out small-pox altogether by ordinary sanitary measures without vaccination. These measures must, however, be perfect, because if vaccination were withdrawn the whole of the new generation would grow up susceptible to small-pox, and, the virus being diffused in such an unprotected population, a universal epidemic could easily be spread over the whole land.

From these observations, which I have penned without the slightest bias on either side, the intelligent reader will, I trust, become enabled to form a correct judgment of what the Government of the country ought to do in respect to legislation on vaccination.

The effects of vaccination are summarized by the Medical Officer of Health for the Privy Council, Dr. Buchanan, F.R.S., in his late Report to the President of the Local Government Board for the year 1881.

In 1881, among 55,000 children who had not been vaccinated, there were 782 deaths from small-pox; among 861,000 children who had been vaccinated, there were 825 deaths from small-pox in London.

If the London children under ten who were unvaccinated had had the protection of vaccination, not 782, but 9, would have died of small-pox during the year.

If the 861,000 vaccinated children had died at the rate of the 55,000 unvaccinated, 12,125 deaths would have occurred from small-pox during the year instead of the 125 that did occur among the London population under ten years of age.

If it be urged, as it has been, that the vaccinated children owed their escape from small-pox not to vaccination, but to the circumstance that they belonged to the richer and better-lodged section of the community, the hypothesis is negatived by the facts.

The children vaccinated at the public expense number about

430,000. This is more than half the child population, and belongs to the poorer population. If the rate of death among the unvaccinated children had prevailed also amongst this poorer section of the vaccinated, then among these children vaccinated at the public expense there would have been over 6,000 deaths from small-pox in 1881. In reality the outside number of deaths was 35, and indeed this poorer half of the vaccinated community had a less mortality than the richer. These facts speak for themselves, and are a clear set-off against 12 deaths registered in London in 1881 as from cow-pox and disease occurring after vaccination.

For my own part, with all the facts that are in my possession before me; with a knowledge that without protection the susceptibility to small-pox is as distinct as ever; with a knowledge that the virus of small-pox is still present in many thousands of centres; with a knowledge that amongst an unprotected community small-pox might easily ravage the whole of a nation; with a knowledge that vaccination, notwithstanding all its drawbacks, is a protective without being an infective disease; and, with a knowledge that sanitary measures are not sufficiently advanced to admit of the withdrawal of the protection of vaccination, it is I feel out of reason to request the Government to break up the great organization for vaccination which it has established. I have been vaccinated myself three times, and have had those who have been under my control vaccinated and re-vaccinated, a practice which is, I believe, all but universal amongst the members of the profession to which I belong, a profession which ought to be best acquainted with its own interests if with none other.

It rests with politicians rather than with the men of science to determine whether it is good practice to make vaccination compulsory, and speaking on the political side I do not think it is. At present the compulsory method is doing the greatest injury to vaccination by making it so unpopular that people will not listen to reason on the merits of the process; in time it will bring discredit on the process altogether, as a useless and tyrannical measure.

In conclusion, it seems to me to be the duty of the Government to retain the existing organization, and to make vaccination as healthy and perfect as possible; but to withdraw all penalties for enforcement, and to stop at once the unseemly trials for

enforcement, which raise an emotional disgust or dislike, without in the slightest degree satisfying the reasoning nature of the people.

Other suggested Prophylactic Inoculations.

In imitation of vaccination, it has of late years been proposed to attempt to prevent other of the spreading diseases than small-pox by means of counter-inoculation, on the homœopathic principle of keeping off a severe by bringing forth a similar but milder disease. There are some who would persuade our Government to let this experiment be tried on our flocks and herds, and who would introduce a series of spick and span new diseases, on the chance that certain old diseases, which are perfectly under sanitary control, may be conjured out instead of being kept out. This would not be a sound governmental proceeding. Already the hypothesists who are the head and front of this experimental crusade are quarrelling amongst themselves as to the validity of their own experimental data. They have not proved to the satisfaction of each other that they have discovered the art of preventing susceptibility by inoculation; and, worse than all, they have not proved that the artificial protective diseases which they think they can induce are not, when once induced, infectious and communicable independently of mere artificial and controllable propagation.

Contagious Diseases Acts.

The Legislature of this country has attempted, through the Contagious Diseases Acts, to suppress, by legal measures, the spread of certain diseases which convey the worst description of contagion and which confer the most destructive heredity. I have studied with the utmost care what has been said on both sides of this important question, and have come to the following conclusions:—

(*a*) That the Acts where they have been applied have tended to the reduction of one of the worst forms of human disease.

(*b*) That, as the advocates of the Acts claim for them, they have conferred advantages other than hygienic. That they have:—

"Diminished prostitution in subjected districts.

"Almost entirely suppressed juvenile prostitution.

"Rescued fallen women from the frightful state of filth and disease in which they had previously lived, and placed them under conditions in which they, for the first time, become amenable to humanizing and reforming influences.

"Contributed to promote public order and decency in the districts in which they are in force."

Water Supply and Drainage.

In the prevention of diseases of the zymotic class it is important, perhaps essential, that the Government of the country should take into its own hands the management of the water supply, and should carry out for the whole country those provisions for such supply, as have been referred to under the head of Local Authoritative Action.

The existing laws relative to the drainage of towns and the purification of watercourses, require entire revision, and cannot too early come before the Legislative Chambers of our own and other countries for that purpose.

CHAPTER VI.

PREVENTIONS OF ACCIDENTAL AND INDUSTRIAL DISEASES.

I.

Personal Rules for Prevention.

In the prevention of diseases arising from accidental injuries, with special reference to those injuries occurring from industrial labor, the personal element of prevention is naturally the first to be considered. In this consideration must, however, be included not only the workers themselves, but those for whom the work is executed. Employer and employed are equally concerned in this labor of prevention.

It must be at once admitted that many employers of labor have found the greatest difficulty in introducing preventive measures, owing to the opposition raised by the persons themselves for whose benefit the measures were invented. This may be, and is, obstructive. It need not be deterrent.

All those diseases which are induced by the absorption of inorganic poisons through the skin or mucous membrane of the mouth, and which are described at pp. 315–330, can only be prevented by extreme cleanliness, and by taking care that the injurious substance, whether it be arsenic, lead, potassa bi-chromate, cyanide salt, or copper, does not remain in contact with the absorbing surfaces. In the working of arsenical preparations this vigilance should be incessant. In regard to the bi-chromate disease, it seems to me that the simple precaution of covering the hands and arms with an impermeable glove or gauntlet is a sufficient prevention.

Prevention of Lead Poisoning.

In lead-working, whether in white lead works or pottery work, extreme care on the part of the workers that they do not take up

their food with hands soiled with lead, is of itself a very considerable protection. In respect to lead-working some recent inventions have reduced, greatly, the danger incidental to the manufacture of white lead. During the meeting of the Sanitary Institute at Newcastle, I had there the advantage of being shown over some large works and of witnessing the process of the manufacture of white lead, from first to last.

In these works a number of improvements are introduced, by which exposure of the skin to the solution containing lead and exposure to inhalation during the process of drying are admirably prevented. In the establishment one workman, who had been engaged for many years and never suffered at all, expressed to me that, by strict attention, there need be no suffering. In a second establishment of the same kind I found another workman who had escaped in a similar manner, and who held a similar opinion as to the efficacy of cleanly attention. He, too, thought that intemperate habits, by leading to recklessness, and by rendering the body more susceptible to the injury, were, in a secondary point of view, exceedingly productive of the mischief.

A good research is required that would help to the discovery of some process by which the use of lead may be dispensed with in the glazing of pottery, and some innocuous substance be put, for this purpose, in its place. Half a century ago the Society of Arts was actively interested on this subject, and awarded, in the session 1822–23, its large gold medal to Mr. J. Meigh, of Shelton, Staffordshire, for a glaze for vessels of common red earthenware, not prejudicial to the health of those who make use of them. Since then, however, but small progress has been made compared with what might have been effected from ingenious and persistent experimental inquiry. Meigh's process is described as follows:

"The rock called red marl is usually in the form of beds, of a soft, coarse, slaty structure, and red color, forming the chief part of the common soil in many extensive districts in this island, to the north and west of a line running obliquely from Durham to Exeter. This marl is easily ground in water to an impalpable powder, which remains suspended for a considerable time in the fluid. A mixture of this kind is prepared, and the ware, previously well dried, but not burnt, is immersed it. The superficial pores of the clay are thus filled with fine particles of the marl, and a fit surface is prepared on which to lay the glazing. Being

again carefully dried the ware is ready for the glaze, which is thus composed :—Take one part Cornish granite, consisting chiefly of felspar, one part glass, one part black manganese, the whole well ground together, and diffused in water, to the consistence of cream. Dip the ware in this mixture, and, when thoroughly dry, place it in the kiln, and fire it in the usual way. The result will be a solid black glaze, very permanent, and not containing any ingredients noxious to health. If an opaque white glaze is required, omit the manganese."

Mr. Meigh also employed common marl and the red marl as ingredients of the body of the ware, with excellent effect, without increasing its expense; he used for this purpose four parts of common marl, one part of red marl, and one part of brick clay. Vessels made of the above mixture were in the possession of the Society. The color of the body is a reddish cream brown; it is harder, more compact, and less porous than the common red ware; and its general adoption with the above-mentioned glaze, might contribute, in a considerable degree, to the health of the lower classes, by whom alone the common red ware is used for vessels of cooking.

Experiment on an extensive scale is wanted still, to settle the question whether the above-named method, or any other similar, can be rendered serviceable for taking the place of lead in the glazing process.

Encouragement should always be given to the introduction of paints for house-painting which are free of lead.

Preventions of Injuries from Gases and Vapors.

To prevent the diseases arising from the inhalation of gases and vapors, the grand desideratum is to allow the freest possible ventilation. When that is possible the danger is limited. There are, however, some gases and vapors to which, in my opinion, it is wrong that any person should be subjected at all. Bi-sulphide of carbon vapor is one of these deadly agencies. Chlorine is another. The present plan of letting the workmen go into the chloride of lime chamber while there is free chlorine present is altogether unnecessary and altogether improper. It would be the simplest thing to construct a chlorine chamber, in which by means of a large volute, the lime could be changed into chloride,

and the product, chloride of lime, swept out without any person being exposed to the chlorine gas.

In the course of the last few years many improvements have been carried out in different factories where danger in previous times was imminent. At Amiens, M. Kuhlmann devoted much attention to the process of fixing chemical vapors given off in various processes of chemical manufacture. He invented a mill in which the vapors are carried into neutralizing solutions, being distributed in fine division almost like spray. In some aniline works in France the distinguished Chevalier successfully exerted his ingenuity in constructing a special room for the manufacture of aniline, so arranged that exposure to the vapor is practically an impossibility, and is indeed placed out of the range of the workman though he be even careless in the performance of his work.

With a similar worthy object of applying scientific skill to the protection of the working man in the factory, M. Galibert has invented an air reservoir, made for economy's sake of a goat-skin, by the use of which a man may carry with him on his back a good supply of pure air, and, by a little practice of breathing through a valved mouthpiece, may work in a deadly poisonous atmosphere without risk.

For the prevention of danger from exposure to poisonous vapors or gases there is now invented an apparatus by means of which a workman can actually remain for long periods of time in a room charged with a fatal atmosphere. The apparatus is that invented by Mr. Fleuss, and consists of a breathing-mask connected with a supply of condensed pure oxygen, and with a chamber through which the expired air is cleared of the poisonous products of respiration. The person supplied with this apparatus makes an atmosphere for himself independently of that which is outside of him. He can live under water, and he can live, as I have shown, in the most dangerous gases without experiencing any harm. The apparatus ought to be extensively used in various manufactures where dangerous gases are being given off.

Preventions of Injuries from Dusts.

For preventing disease from the inhalation of dusts the prime consideration is to introduce perfect means of ventilation, so that the particles of dust, whether organic, inorganic, or metallic, may be carried away.

In manufactories, such as needle manufactories, where steel dust is carried into the air, this method of ventilation, with the air always in motion and directed in such manner as to carry the particles of dust outside, answers exceedingly well. I found the same to obtain in certain of the flax manufactories in Ireland, which I visited not long since.

In factories where steel grinding goes on to a large extent, the magnetic plate for drawing down the particles of steel to itself is very useful. It has never been popular amongst the workmen, but it is exceedingly scientific, simple, and efficient.

At first sight it would seem a very easy task to invent a mask which shall exclude the particles of dust, and yet admit, freely, the atmospheric air. But when we come to the practical art of construction, the task is not so easy as it looks. We may succeed in keeping out the dust readily enough, but fail in letting in the air with sufficient freedom. We may succeed in excluding the dust and letting in the air, but fail in letting out the expired air with sufficient freedom. We may succeed in keeping out dust, and in letting air both in and out, and yet fail in removing the water that is expired with the breath. Any one of these failures is sufficient to spoil a mask intended for ready, prolonged, and easy application.

Messrs. Krohne & Seseman, the surgical instrument makers, of Duke Street, Manchester Square, have introduced a Swiss ori-nasal mask, made of vulcanite, in which the air is drawn through a layer or thin pad of cotton-wool which can easily be changed. The instrument is simple, and at first it seems easy to work. But in a little time the cotton-wool is saturated with water from the breath, and the breathing becomes difficult, even in pure air. In air charged with dust the cotton pad is choked with the mixture of moisture and dust.

A second respirator introduced by the same firm, is made of layers of crape spread over a light wire framework. It is easily put on and off, and it lets air freely in and out. It has two faults —it allows water to accumulate in its meshes, and it filters badly. It answers fairly for very coarse dusts, but the finer sorts, such as flour, draw through it almost as easily as if nothing were in the way.

A third contrivance has been invented which is much more elaborate. In this a filter, made of porous woollen-material, is

enclosed in a perforated metal box which is worn on the breast, suspended by a cord that passes round the neck. The breathing-tube is held in the mouth, and the inspiration is made by the tube through the filter. The expiration is through an independent valved opening, the valve being very light and easy of movement. This apparatus has two advantages; its filter does not become damp from the condensation of water by the breath, and its filtrating surface is large and free. The objections to it are, that all the air has to be drawn through it by the mouth, an unnatural effort which cannot be persistently sustained for long periods of time; and that, with the utmost care in breathing by the mouth, care brought by habit to second nature, some dust will find its way into the lungs by the nostrils. The success of the apparatus is, therefore, not certain. The apparatus is also costly, and though it is neat, ingenious, and a really good filter, it could not, I think, be expected to come into general use.

I have myself made many experiments in order to construct a perfect mask for the filtration of dusts, and after testing various kinds of filtering substances, I have come to the conclusion that fine feathers are the best. They are very light, they separate perfectly, they admit air in any quantity; while excluding dust, and they absorb less water than perhaps any porous flexible substance. They have the further advantage of being cheaply procured, and of being easily made into filters.

I tried to imitate with them the ciliary process of filtration by a wheel of feathers placed in a mask, which should draw to an opening during inspiration, and expand like a fan during expiration. By this movement, I thought the feathers would filter during inspiration, and would be cleared of their dust during expiration. The plan succeeds well for a short time, but, as the balance of the wheel must be finely set, it soon gets out of gear, an accident fatal to success. I planned next to fix the feathers transversely within a breathing-tube, giving them a direction so that in inspiration they would be drawn across the tube to filter, but in expiration would be given out against the side of the tube. This plan was imperfect, because the feathers could not be freed of their accumulated dust by the act of expiration.

Lastly, I tried to make a mask by rolling the feathers round the inside of a breathing-tube, and so arranging them that in inspiration they would rise up and filter, while in expiration they

would be carried down the tube like a valve. In this last plan, lightness, dryness, good filtration, and self-cleansing of dust are insured, and I do not think any better or simpler plan has been constructed. In order to adapt the filtering tube to the face of the worker it is placed in a mask which can be put on and taken off as easily as if it were a pair of spectacles. The filtering tube is so placed as to catch all the inspired air, and by means of two side expiratory valves nearly all the moisture of the breath is set free. But, light as the mask is, it is not approved of by those who wear it. It causes, it is said, closeness of air, and it looks unsightly.

Mr. Baker invented some years ago a crape mask for flax-workers. It answered, but was not popular.

II.

Local Authoritative Preventions.

But little can be done by local authoritative action for preventing the industrial diseases. One suggestion is, I think, worthy of being expressed in this place.

Public Work-rooms.

The suggestion is, to build in all our great industrial hives public work-rooms for the use of those industrials who are now obliged to work at home in their little stifling rooms, which are at once living-rooms, bedrooms, and workshops. The new work-rooms ought to be distinct blocks, and arranged so that every person should be able to have his own office or workshop at a moderate cost per week. Each block of such rooms should be placed under proper superintendence, that intruders be not admitted, and each room should be applied to no other purpose except the work for which it was let, and should be occupied by no more persons than could work in it with perfect safety to health.

If these public work-rooms were established, the benefits resulting from them would be incalculable. The workman would pursue his avocation freed from those domestic cares and troubles which surround him in his household. His wife and family would be left to live freed from the constant plague and worry of business and labor, while the simplest industrial worker would

have the same advantages as the professional man, who in the office can transact business relieved from all the annoyances which, of necessity, attended the processes of working for bread and living within the same four walls.

The industrial classes would profit by this reform, and every class of the community would also profit by it, in some if not an equal degree. As things now are the private work-rooms are foci of the spreading diseases. In these rooms, where lie the victims of scarlet fever and other contagious diseases, clothes are made which are to cover the bodies of the wealthier classes and to carry those particles of diseases which flourish wherever they are introduced, when those who are susceptible to their influence are exposed to them.

III.

Central Authoritative Preventions.

The whole subject of Central Legislative action in regard to industrial diseases requires to be recast. The English were the first people to endeavor to do away with some of the evils connected with industrial pursuits, and in 1802 the first Legislative Act concerning the labor of children was passed, an Act from which all similar legislation relating to industrial occupations has taken origin. The time has come for revision of what has been done.

Revision of Factory Labor.

The Legislature might with advantage enlarge the powers of the certifying surgeon in the factories, to enable him to be of service beyond the mere duty of certifying as to age. In the Factory Act age is treated as though it were another term for strength, which we all know is a fallacious idea, and what is really wanted is, the correction of so great an error. To the health and the life of the operative, it is essential that the authority of the surgeon should be extended, and that strength as well as age should be brought into consideration. It is essential, I mean, that a surgeon when he sees a child put to a work which it has not the strength to carry out, should be able to say, "This shall not be; this child must be set to another and easier task." In further exercise of useful duties, it seems important that the powers of the

factory surgeon should extend to the correction of other sources of danger, to the supervision of the health of the adult operatives, and to the direction of the sanitary condition of the factory.

There are some other directions in which it would be wise to extend the powers of the factory surgeon. He ought to be enabled to carry out his duties in workshops as well as in factories. I think his power ought to extend further even than this; that it ought to reach into those places called work-rooms in private houses. In small shops and work-rooms more injury is inflicted than in the factory, and to let the young remain unprotected from the most dangerous forms of labor, on the mere pretence that they do not work in a place legalized as a factory, is a legislative failure of the saddest character.

To the application of remedies for each one of these errors we might surely, without hesitation, demand the service of the Legislature.

A legislative reform is required in regard to the regulation of age at which half-time work should commence. The teachings of science are clear, that no child of either sex should be put to work at too early an age. Twelve years is the earliest age at which any labor should be commenced. Even then the kind of labor ought not to be indiscriminately left to the choice of the employers; it ought to be placed under the wise direction of educated medical men who know what can and what cannot be borne by the laborer.

CHAPTER VII.

PREVENTIONS OF SOCIAL AND PSYCHICAL DISEASES.

I.

Rules for Personal Preventions.

The personal rules which require to be carried out in order to keep in check the social and psychical causes of disease embrace all those various attentions to domestic, individual, and scholastic life which tend to make existence truly agreeable, chaste, cleanly, and free from care.

Warming and Ventilation.

In addition to the attention which should be paid to the drainage of the house, a point already considered, in addition to the raising of the house a little distance from the ground and the construction of it with materials which will not absorb and retain water, the house should be so planned in all its parts as to equalize the temperature of the various rooms as far as possible. Pointed roofs are opposed to this arrangement by presenting too large a surface for cold and evaporation, the chamber or attic immediately beneath such a roof being always seriously affected by external extremes of moisture and temperature.

The ventilation of each apartment or floor should be independent and derived from the outside air, not drawn from the basement by a staircase shaft. The circulation of air should include warming, so that the heat from every fire in the house may be used as a ventilator and a warmer.

The difficulties to be overcome in ventilation and warming are still very great. Many plans have been tried and found wanting; some for ventilation simply, others for warming simply, and others again for combining the two. It cannot but be conceded

that those plans succeed best which accomplish the one by the aid of the other.

It must be remembered that the amount of air required by each adult person is 3,000 cubic feet per hour. Children need almost as much, owing to the more rapid breathing and the quicker chemical changes which their growth and development demand.

Such a consumption of air would require the contents of a room ten feet square to be changed three times every hour.

Space is not everything in ventilation. Some persons think that because rooms are large and lofty, the matter of changing the air may be more or less left to take care of itself. This is a mistaken view, for the height of an apartment may be a real disadvantage, the upper part becoming a species of reservoir for impure air which cannot escape and which, as it becomes cooler, sinks and diffuses into the common air below.

It follows that there should be an abundant supply of fresh air, and also means of exit for the used air. The rate of movement in the air admitted should never exceed 5 feet per second. If it do, draughts are felt, and we know by experience the serious evils which follow in their train.

The chimney-shaft, protected by an Arnott's or similar valve, is the best exit for the air of a room.

Pure Air, Light, Water.

A leading principle in the construction of the healthy house is to put into it, for building purposes and for furnishing purposes, as little as possible of all substances that hold and retain those specific particles of disease which, being set free, spread by diffusion, and excite their specific diseases. Thus, in all constructions porous materials are bad; absorbing materials are bad; materials such as thatch and straw for roofings are bad. In furnishing, woollen and fluffy materials are bad; heavy curtains to beds and windows are bad; carpets which cover the whole of a room are bad. In a word, all materials that catch dust, keep dusty, hide dust and, on being shaken, yield clouds of dust, are bad.

Light should be freely admitted into all parts, cupboards and closets as well as sitting- and bed-rooms, for sunlight is in itself a potent purifier. One great evil of the gloomy cloister-like style of building is that the darkness hides lurking dust.

All water for drinking purposes should be filtered. Cisterns are at present a necessity, and should therefore be kept as pure as possible by periodical cleansings.

Summary of Healthy Essentials for the House.

(*a*) Separation of the house from direct contact with the earth.

(*b*) Complete separation from the sewer or cesspool.

(*c*) Freedom from collections of damp and dust.

(*d*) Separation, by air communication, between floor and floor.

(*e*) Unobstructed and instant drainage.

(*f*) Equalization of temperature.

(*g*) Independent ventilation of rooms, with utilization of every fireplace for warming and ventilation.

(*h*) Free admission of light.

(*i*) Perfect filtration and cooling of water.

Summary of Healthy Essentials for the Bedroom.

1. The bedroom, as the apartment in which a third portion of life is or ought to be passed, should be the room most carefully provided for, in relation to sanitary requirements.

2. A bedroom should always be cheerfully furnished. The furniture should be light and incapable of holding dust. The walls should be distempered, of a light bluish-gray or sea-green color. A southern aspect for the window is best.

3. Each sleeper ought to be supplied with 1,500 cubic feet, at least, of breathing space.

4. Air supplied for bedrooms ought to be drawn immediately from the outside, and should never be permitted to enter from inside passages, or be carried upwards from the basement. The "costless" ventilation plan, of Mr. P. H. Bird, is an excellent one for accomplishing this end; better still, is a fire-stove, which warms and delivers pure warm air freely and systematically into the room.

5. Free exit should be made for the air by the chimney-shaft.

6. An equable temperature of 60° Fahr. should be maintained in the apartment during its occupation.

7. Daylight should, when it is present, at all times be freely admitted into the bedroom. It should be shielded from the

eyes of the sleeper, but permitted to "flood" the room generally unimpeded by dark blinds or heavy curtains.

8. All extraneous articles of furniture should be dispensed with. Lumbering pieces of furniture reduce the air space of the apartment and retain dust.

9. Every sleeper should have a separate bed.

Preventions of Psychical Disturbances.

For the prevention of the great class of psychical causes of disease the leading points to be recalled are,—An education of the young which will not produce overstrain of mental or physical power: the cultivation of habits of temperance, cleanliness, and purity of mind as well as of body: the formation of fixed and regular habits, and especially of the habit of going early to rest and of rising early in the day: the encouragement of all mental and physical games and exercises which lead to variety of accomplishments without any undue pressure or exclusive development of organic structures or mental faculties.

II.

Local Authoritative Preventions.

Constitution of Local Authorities.

It is a good practice in the formation of local boards for sanitary purposes to elect from all classes of the community, which are eligible for election, the persons whose duty it is to carry out the details of administration.

It would be exceedingly wise also to let women become eligible for seats on local sanitary boards; for women are by nature sanitarians; they see the lights of health and the shadows of disease much more acutely and keenly than men do. They are quick at suggesting sound and wholesome reforms, and they know infinitely more about the domestic life and the home than men know. When they are well informed and interested in sanitation they are allies of the first order; while, when they are not informed and are not interested in reforms they are opponents which no man and no board can withstand.

Some general system requires to be introduced for regulating the numbers that shall constitute a local sanitary council in each

locality. At present the system, if that may be called a system which has nothing systematic in it, is altogether irregular. In some places there are too many, in other places there are too few, local health legislators. In the largest places there ought to be one local representative of health to three thousand of the population, as a minimum of representation.

Again, in respect to the selection of sanitary boards more care than now exists should be taken to select members to serve in answer to local demands within the district itself. I mean by this that each person elected should have under his particular knowledge and interest his or her particular district, the requirements of which should be at all times before the mind. The district would in this manner be under the most perfect observation, and the Medical Officer of Health would at all times have the most valuable help at his command.

The Medical Officer of Health.

In every local district the Medical Officer of Health should have the true place that belongs to him in all that relates to official action bearing upon health. He should hold to the sanitary department just the same position as the Recorder does to the legal. He ought not merely to be the adviser of his board, he ought, by virtue of his office, to be the chief and chairman of the sanitary department. He ought to be elected for a definite period; he ought to be upheld in every useful health reform he brings forward; he ought to be encouraged to inaugurate reforms; he ought to be placed in such an independent position that he can inaugurate any reform and correct any evil without being subjected to the risk and personal anxiety of dismissal for good service. He ought, in a word, to be able to put down disease of which he is the medical judge as freely, as unsparingly, as fearlessly, as the legal judge or magistrate puts down crime. Until this is the rule medical officers of health will remain as mere clerks and chroniclers of disease; suggesters of placebos in sanitation; scapegoats of sanitary blunderers; gentlemen of education engaged by money for perfunctory service.

Utilization of Soft Water.

In a town properly drained the storm or rain water ought to be caught as it flows from roofs of houses and other buildings, and,

in a more systematic manner than has ever yet been done, purified, filtered, and stored for domestic use. In an improved manner the old-fashioned system of collecting storm water should be adopted, by common consent and common arrangement, by the whole of a town. There is now invented a very effective soft-water collector and filter, and the obtaining of good iron cisterns for storage is not much trouble and not much expense. The water filtered and stored under the direction of the local authority could be supplied at different parts of a town by sale at a small cost per gallon: it might be laid on to houses that required it, at a comparatively trifling expense, and be supplied by meter.

It would be good practice for local authorities to supply their localities with water artificially softened.

A water to be quite free from injury to health should not have more than 8° to 9° of hardness, and when it exceeds that it should, by the lime-softening process, be brought down to the proper standard. In Canterbury the authorities have carried out this process, and nothing could be more satisfactory than the result.

Water Supply at Uniform Temperature.

The idea of keeping a town supplied at all seasons with water having an uniform temperature is a modern development capable of wide extension. We are indebted for it to Mr. Baldwin Latham, and, in my opinion, the debt is considerable. Mr. Latham urges that in summer-time the water stored in houses, or even in outside reservoirs, becomes heated, and by that means is a ready cause of decomposition of organic matter, and a cause, indirectly, of the intestinal disturbance which is often present in hot sultry weather. To prevent this accident Mr. Latham has invented an ingenious plan, by which he brings the water into every house by a tube which has been driven into the earth to a point where there is a persistent low temperature. In the summer season, the water drawn into a house furnished with this tube is what is called cold, and, what is of importance, it remains of equal temperature and drinks like fresh spring water. Latham's would probably be too expensive a process to introduce into every house, although the simple and rapid manner by which the tube is driven into the ground is a model of ingenuity. But the plan might be applied to towns by the local authorities.

Drinking Fountains and Public Lavatories.

Drinking fountains, artistic in construction, should give out pure water to man, to beasts of burden, to cattle, and to our best of friends the dog, who, suffering from want of it, is apt, unwittingly, to be affected with disease of madness, and to become in that state one of man's most dangerous enemies.

Public lavatories are a demand as great as drinking fountains, with which in many instances they might be conveniently associated, a lavatory for men on one side of the fountain, and for women on the other. In such lavatories there ought to be every convenience for ablution, and a dressing-room. There might also be, as has been suggested by the promoters of the Châlet Company, a space allowed in which travellers could for a small fee leave, temporarily, a travelling-bag or parcel.

The Manufacture of Bread.

One of the oldest arts in the world is, perchance, the art of making bread, and yet this is, of all arts, the one least advanced as a pure and cleanly process, healthful alike to those who make and those who take. The more we examine the condition of bakeries in town and country, the more, as sanitarians, we wonder that human beings can be found, at any price, to undergo the penalty of being enslaved often half the night underground, exposed to varying temperatures and foul gases, and engaged in a labor that is as laborious as it is unwholesome. The more also we wonder that sensible people should be content to eat of bread made under such conditions, and worked as dough by the naked limbs of the unhealthy workers. For all sakes the bakeries in every town call for incessant supervision, for perfect sanitary construction, and for the introduction of the pure and simple process of manufacture by machinery.

Formation of Public Abattoirs.

The claims of morality and of humanity as well as of health demand in every locality that the private slaughter-houses should be replaced by the public *abattoir*, with its sufficient and cleanly lairs, its proper killing-places and rooms for dressing the carcasses, its lavatories for the workmen, and its cold storage-rooms for the reception and wholesome preservation of carcasses and joints.

Each *abattoir* should be under the inspection of the officer, who, after the Jewish fashion, should inquire into the condition of the flesh of animals used for human sustenance.

Common Lodging-houses.—Schools.

The common lodging-houses required for itinerant wayfarers should have all the healthy necessities for temperance, cleanliness, and chastity present in the best lodgings. Luxuries are not called for, necessities are; and for the poorest, necessities, at least, should be at hand. I know that uncultivated moralists of some schools, anxious ever to make man out to be a greater sinner than he really is, are too apt to throw all the burden of the sins of a community on the most unfortunate members of it, and to feel or even express that, for them, anything is good enough. The argument is as false as cruel, and, like all wrong, rebounds. For these unfortunates left to their own unhappy fate are the plague-spots of communities, and repay neglect by transmission of misery.

In the schools where the young are congregated, there should be special and regular inspection in order to see that these places do not become centres of infection. Rules of the plainest kind should be supplied to the schoolmasters and schoolmistresses, instructing them how to detect infectious and other diseases produced within or imported into the school.

Recreation Grounds.—Public Roads.—Homesteads.

Beyond the social and political necessities for the care of the poor, the local authority should make certain particular provisions for the maintenance of their health. For the young it should insure good playgrounds and parks for *re*creative life, so that recreation may, in its strictest sense, be not a word but a reality. For the poor more advanced in life the local authorities ought to provide artistic and refined amusements in the form of out-door music, museums, and picture galleries.

For health's sake, there should be better care than is now generally pursued in the preservation of roads. Roads should be made not only smooth, but planned in such a way that water does not accumulate upon them. In towns they should be rapidly and systematically cleared of manure and other organic *débris* with which they become polluted.

In country districts, the farm-yards and homesteads call for

better supervision than has yet been applied to them. The farm-yard with its decomposing litter, in which pigs and other animals wallow, with its manure-heaps, with its stagnant outside ponds and often unwholesome out-houses, is a direct and indirect source of disease which ought not to be longer permitted by any local authority.

In towns not less care ought to be taken to prevent the uncleanliness and risk which occur in the mews and other places where li ing animals are kept

III.

Central Authoritative Preventions.

Central authoritative direction on legislation is now demanded in so many ways, that nothing less than a special inquiry into the existing state of the laws relating to health, and leading to unification of law and simplification of law, can ever meet the many social changes that are absolutely required. Everything is piecemeal in present sanitary legislation in all its bearings on social life. I can but touch, therefore, on such existing wants as have been brought before me in the most persistent way under the teachings of every-day practical inquiry. Amongst distinctive legislative requirements the following seem the most urgent.

Water Supply.—Building.—Air Purification.—Sepulture.

The supply of water to all the towns and villages of the kingdom ought to be under the direction of the central government, either directly or indirectly, through the control it can exercise on local authorities, so that all private companies and monopolies may be removed. All those parts of existing Sanitary Acts which refer to the drainage of towns, to the direction of sewers and the purification of watercourses, should be recast and rendered definite.

The central authority should empower the local to insist that owners of property construct all residences and other species of building of proper material, and on correct principles for health.

The central authority should direct the local to provide in every place for the lighting of towns, and purification of the air from smoke and other products of combustion which are injurious to health.

The central authority should direct the local to provide proper mortuaries, so that the dead in the crowded living may be removed to a fitting temporary place of rest, with all that ministers to the respect due to death. It should also direct that the ancient and most useful officer, the Coroner, should have a court-house, where, with the solemnity befitting the vocation, he and his sworn men should perform their important duties.

And still in England, if we would have every town healthy, it is necessary to continue to improve the places of sepulture. Our cemeteries for about half a century have been sufficient for the purposes for which they are intended. They are becoming too crowded now, and some of them so crowded as to offend the senses. A revision of law is immediately demanded in this direction, by which, what is known as earth to earth burial should be provided for in every cemetery, and by which, under proper legal restriction, cremation should be permitted whenever it may be desired. Cremation is becoming an actual necessity.

Suppression of Alcoholic Evils.

Lastly, for social health three great legislative reforms are required in relation to the sale of alcohol and the treatment of the worst sufferers from that agent. The first of these reforms is the establishment of local option, combined, I think, ultimately, with increased taxation on all alcoholic drinks. The second is so to improve the temporary Act which permits the establishment of homes for dipsomaniacs that confirmed inebriates can be received in them with less trouble and difficulty than is now experienced. The third is to provide probationary homes for the dipsomaniac criminal classes, where, on the plan suggested by the Rev. C. Horsley, these classes can be retained for continued reformation under entire abstinence from strong drink, after they have finished the term of their sentence in the prison.

A Ministry of Health.

For the complete carrying out of the Central Health Department of this country, in all its details, one further reform is required, and that is a Ministry of Health, which shall, in the various departments connected with it under the control and direction of a Minister of Health, collate all the registrable facts

bearing on disease and mortality; all the facts relating to meteorology and climate; all the details relating to the laws connected with local self-government; and, everything which publicly is included under the head of State Medical Jurisprudence. Such a Ministry would not only be of the greatest advantage to the country, but, thoroughly organized and efficiently served, would be sure to win the confidence and respect of other countries, and would serve as a model for countries less advanced than our own in the science and art of sanitation.

CHAPTER VIII.

PREVENTIONS OF SENILE DISEASE.

The rules for the prevention of senile disease are all personal. They should begin in youth. It should be a rule amongst grown-up persons never to subject children to mental shocks and unnecessary griefs. When in the surrounding of the child life some grave calamity has occurred, it is best to make the event as light as is possible to the child, and certainly to avoid thrilling it with sights and details which stir it to the utmost, and, in the end, only leave upon the mind and heart incurable wounds and oppressions. Children should not be taken to funerals, nor to sights that cause a sense of fear and dread combined with great grief, nor to sights which call forth pain or agony in man or in the lower animals.

To avoid premature old age in mature life the following are important points to remember.

Grief anticipates age. Dwelling on the inevitable past, forming vain hypotheses as to what might have been if this or that had or had not been, acquiring a craze for recounting what has occurred,—these acts do more harm to future health and effort than many things connected with real calamity. Occupation and new pursuits are the best preventives for mental shock and bereavement.

Hate anticipates age. Hate keeps the heart always at full tension. It gives rise to oppression of the brain and senses. It confuses the whole man. It robs the stomach of nervous power, and, digestion being injured, the failure of life begins at once. Those, therefore, who are born with this passion, and a good many, I fear, are, should give it up.

Jealousy anticipates age. The facial expression of jealousy is old age in however young a face it may be cast. Jealousy preys upon and kills the heart. So, jealous men are not only unhappy

but broken-hearted, and live short lives. I have never known a man of jealous nature live anything like a long life or a useful. The prevention for jealousy is diversion of mind towards useful and unselfish work.

Unchastity anticipates age. Everything that interferes with chastity favors vital deterioration, while the grosser departures from chastity, leading to specific and hereditary disease, are certain causes of organic degeneration and premature old age. Thus chastity is preventive of senile decay.

Intemperance anticipates age. The more the social causes of mental and physical organic diseases are investigated, the more closely the origin of degenerative organic changes leading to premature deterioration and decay are questioned, the more clearly does it come out that intemperance, often not suspected by the person himself who is implicated in it, so subtle is its influence, is at the root of the evil. Born a total abstainer, no man, no woman, should break the rule of abstinence; having broken it, all, who are wise, should return to it and adhere to it.

When old age has really commenced, its march towards final decay is best delayed by attention to those rules of conservation by which life is sustained with the least friction and the least waste.

The prime rules for this purpose are:—

To subsist on light but nutritious diet, with milk as the standard food, but varied according to season.

To take food, in moderate quantity, four times in the day, including a light meal before going to bed.

To clothe warmly but lightly, so that the body may, in all seasons, maintain its equal temperature.

To keep the body in fair exercise, and the mind active and cheerful.

To maintain an interest in what is going on in the world, and to take part in reasonable labors and pleasures as though old age were not present.

To take plenty of sleep during sleeping hours. To spend nine hours in bed at the least, and to take care, during cold weather, that the temperature of the bedroom is maintained at 60° Fahr.

To avoid passion, excitement, luxury.

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